LIGHTING SURVEY

ELECTRICAL REVIEW

FRIDAY
8 SEPTEMBER 1961

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Why 4 out of 5 women go for **Mazda**

Netabulb

4 out of 5 women prefer a smaller bulb that has a neater, trimmer shape.
They go for NETABULB

4 out of 5 women like a bulb that's snug in the smaller modern fittings.
They go for NETABULB

4 out of 5 women prefer a bulb whose whiter light is kinder to the eyes.
They go for NETABULB

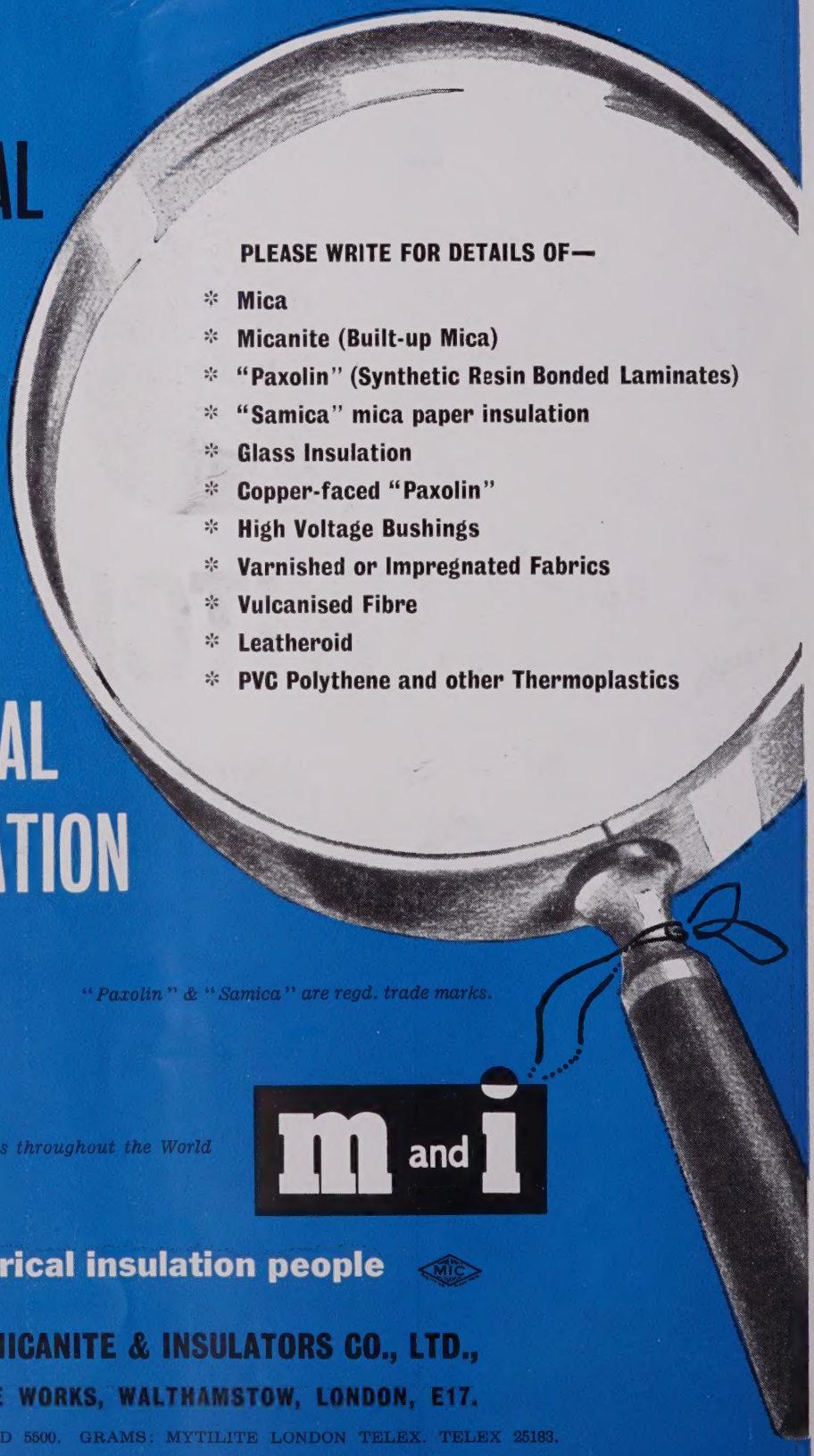
Mazda lamps stay brighter longer

A.E.I LAMP AND LIGHTING CO. LTD.

4899

WINGS DAY
SEPT. 16th
GIVE FOR THOSE WHO GAVE

TO ELECTRICAL ENGINEERS LOOKING FOR THE FINEST ELECTRICAL INSULATION



PLEASE WRITE FOR DETAILS OF—

* Mica
* Micanite (Built-up Mica)
* "Paxolin" (Synthetic Resin Bonded Laminates)
* "Samica" mica paper insulation
* Glass Insulation
* Copper-faced "Paxolin"
* High Voltage Bushings
* Varnished or Impregnated Fabrics
* Vulcanised Fibre
* Leatheroid
* PVC Polythene and other Thermoplastics

"Paxolin" & "Samica" are regd. trade marks.

Agents in most territories throughout the World

m and i

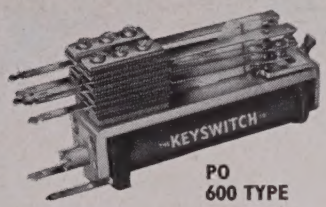
the electrical insulation people

THE MICANITE & INSULATORS CO., LTD.,

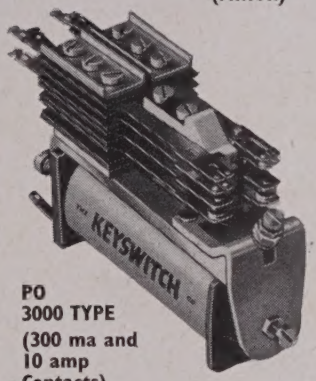
EMPIRE WORKS, WALTHAMSTOW, LONDON, E17.

TEL: LARKSWOOD 5500. GRAMS: MYTILITE LONDON TELEX. TELEX 25183.

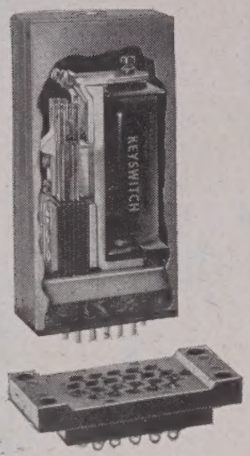
RELAYS



PO
600 TYPE
(MINOR)



PO
3000 TYPE
(300 ma and
10 amp
Contacts)

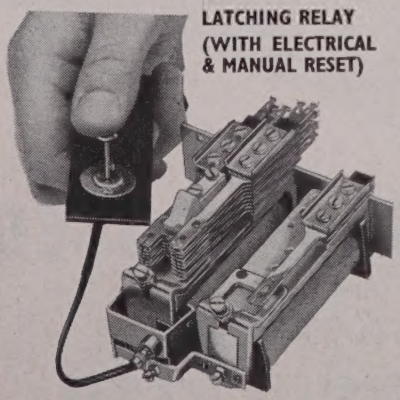


PLUG IN 3000 TYPE
RELAY
(METAL COVER)

CONTACT SALES DIRECTOR

KEYSWITCH RELAYS

IRONGATE
WHARF ROAD,
PRAED STREET,
LONDON, W.2
Telephone:
PAD. 2231
(6 lines)



LATCHING RELAY
(WITH ELECTRICAL
& MANUAL RESET)



SILENT
30 AMP
RELAY
CONTACTOR

(Mains
Operating
Unit)



PLUG IN
3000 TYPE

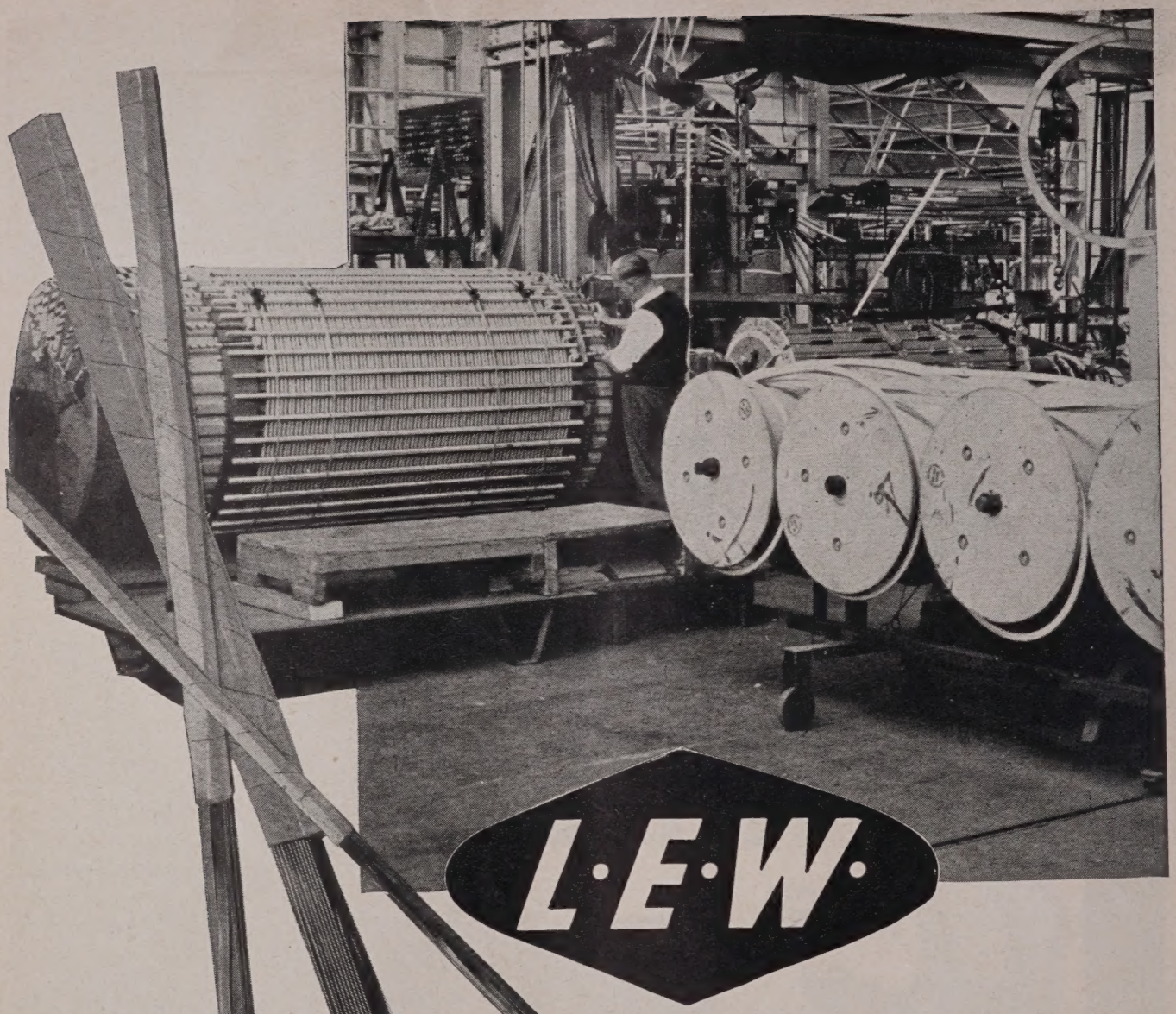
(TRANS-
PARENT
COVER)

WITH
TRANSIS-
TORISED
AMPMETER

Manufactured as required for customers' own applications in :
AUTOMATION • COMPUTERS • TELEPHONE and INTERCOM SYSTEMS • BATCH COUNTING and PHOTO-ELECTRICS • MOTOR and MACHINERY CONTROL • AUTO-TIMING and AUTOMATIC SIGNALS • CURRENT and VOLTAGE REGULATION, etc.

A unique Calculator providing full Relay Specifications is available FREE on request.

Extremely advantageous quotations can be offered for quantity orders.



WINGS DAY
SEPT. 16th
GIVE FOR THOSE WHO GAVE

TRANSPOSED LEWMEX INSULATED STRIP

for Transformer Windings

Transposition	Strips from ·050″ to ·100″ thick
5 to 29 Strips	·120″ to ·300″ wide

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

LEYTON · LONDON · E10

You cannot buy better gear



THE LATEST BILL SWITCHGEAR CATALOGUE
14th EDITION IS NOW AVAILABLE
THIS COMPREHENSIVE 200 PAGE FULLY ILLUSTRATED LIST
SHOWS THE RANGE OF BILL ELECTRICAL
SWITCHGEAR AND ACCESSORIES
CONCISE DATA AND PRICES AT A GLANCE

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BILL SWITCHGEAR LTD.
ASTON LANE · PERRY BARR
BIRMINGHAM·20

LONDON, S.W.1 A. W. ZELLEY, N. PAYNE, R. W. HANKINSON, GILLINGHAM ST.
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EAST MIDLANDS J. A. PEARCE, HEAD OFFICE,
BRISTOL 4 W. L. WHITE CLOTHIER RD.
LEEDS, 14. N. SHARPLES, G. SUTTON, WOODLANDS FACTORY.
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GLASGOW J. D. HARRIS, SANDYFORD PLACE
BELFAST R. A. SIMPSON, DONEGALL ST.

Danger surrounds creatures of the fields and forests. Nature has equipped them to sense it, to be alert to every slightest warning and to take evasive action—on the instant.

In all the years since man first harnessed electricity he has relied on *porcelain* for protection against its hazards. Most widely used insulation material in the industry, porcelain is both versatile and economical.

WADE porcelain has an unsurpassed reputation for accuracy and dependability.

WADE technicians are at your service to go anywhere at anytime. Your enquiries are welcomed and will receive immediate attention.



Think fast Mister Hare!

BECMA — BRITISH ELECTRO CERAMIC MANUFACTURERS' ASSOCIATION

WADE

ELECTRO-CERAMICS

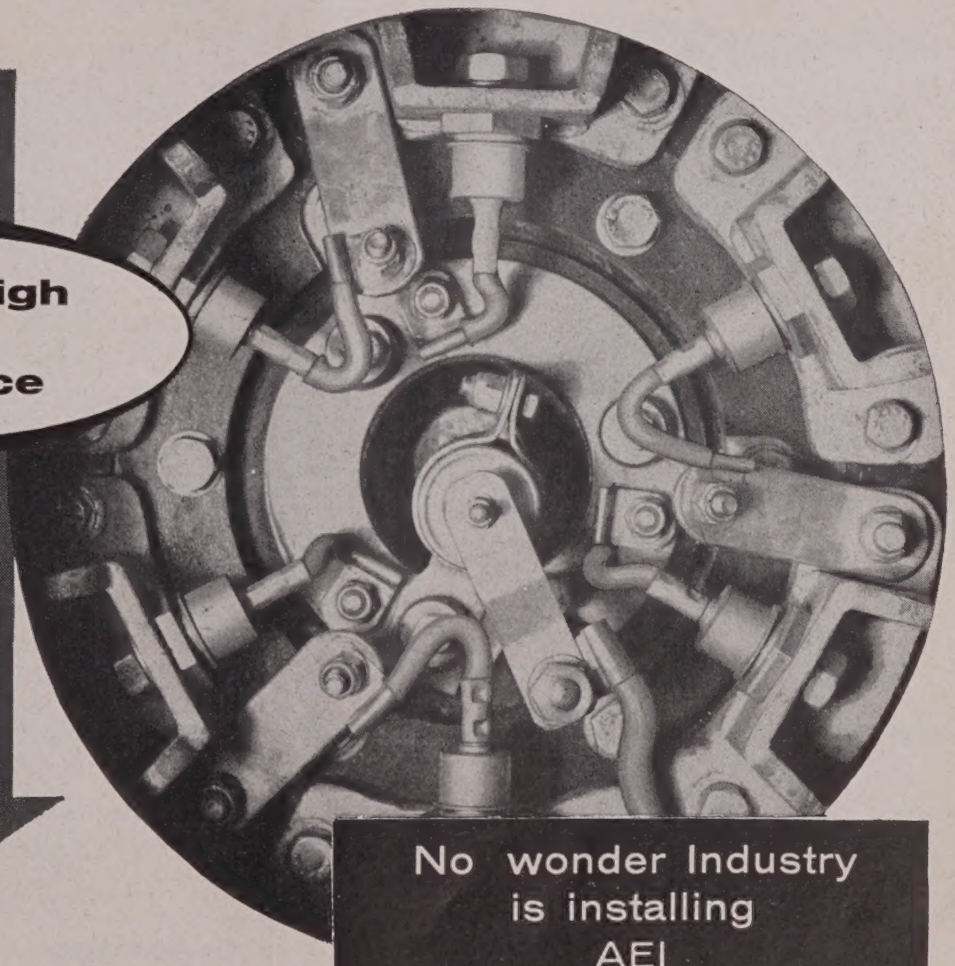
Geo. Wade & Son Ltd., Burslem, Stoke-on-Trent
Wade (Ulster) Ltd., Portadown, Northern Ireland

Members of the Wade Group of Potteries

PORCELAIN FOR INSULATION....WADE FOR PORCELAIN

The case for brushless is overwhelming!

Just weigh the evidence



No wonder Industry is installing AEI BRUSHLESS A.C. GENERATORS

Maintenance costs cut dramatically . . . because there are *no* brushes to inspect or replace, *no* carbon brush dust to endanger insulation, *no* sliprings to be re-ground, *no* commutator to be skimmed.

Because sparking cannot occur fire risk is inherently low.

AEI brushless A.C. generators are particularly useful for standby duty and for service in situations remote from grid supplies.

Write now for leaflet to:

Despite all their advantages brushless A.C. generators cost no more than alternative equipment and are available in an extensive range from 50 kVA up to 5,000 kVA.

AEI

Associated Electrical Industries Limited

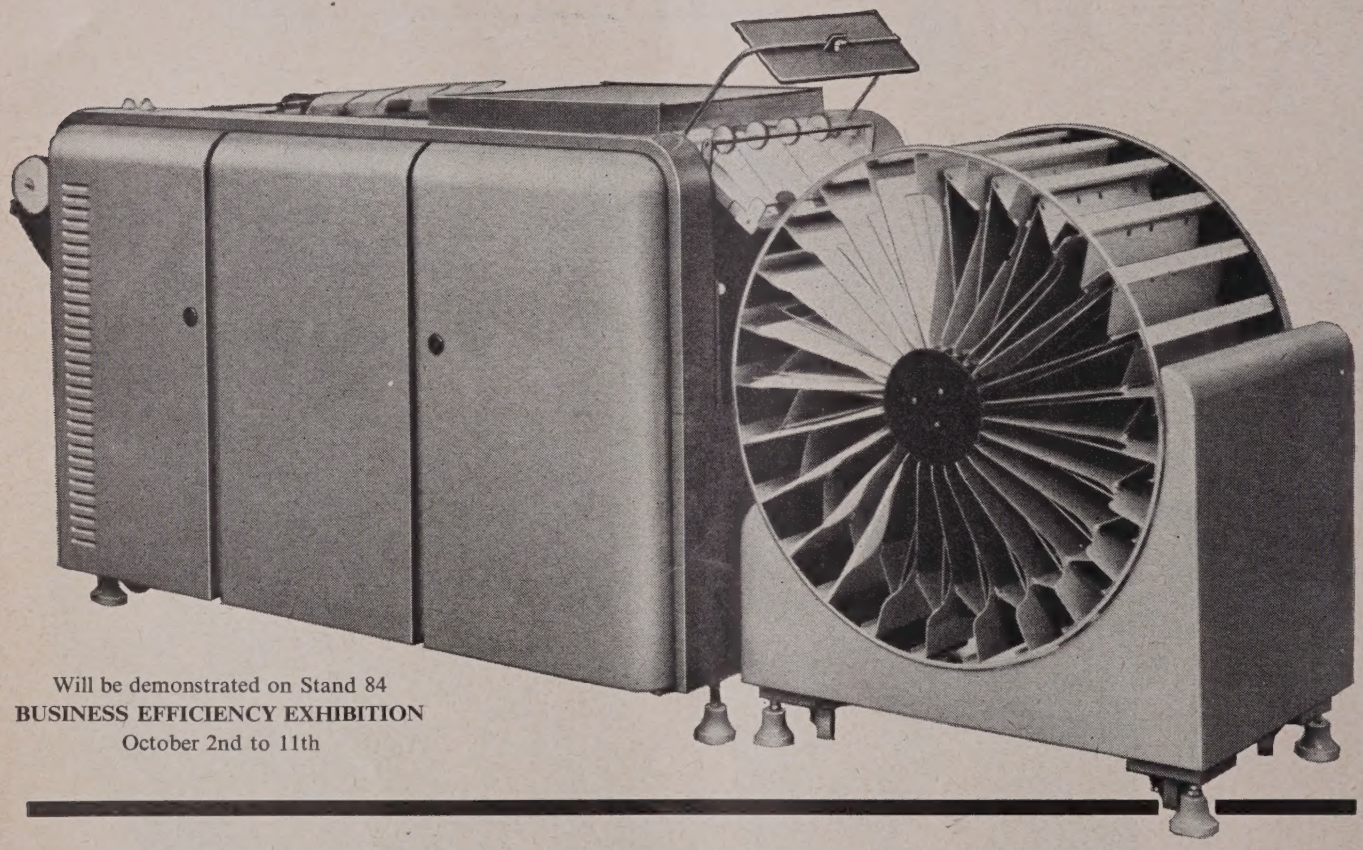
Heavy Plant Division

RUGBY, ENGLAND

A5583

One operator . . . one machine . . .

3000 dyeline prints an hour!



Will be demonstrated on Stand 84
BUSINESS EFFICIENCY EXHIBITION
October 2nd to 11th

Here is the fastest automatic dyeline photoprinting machine in Britain: the ILFORD Azoflex Model 155. Using Azoflex Ninety Ninety paper, and one operator, the Azoflex Model 155 can produce every hour 1500 copies (size 13″ × 16″) or 3000 copies (size 8″ × 13″ or 8″ × 10″) of the following:

- ★ **Computer outputs**
- ★ **Engineering drawings**
- ★ **Parts lists**
- ★ **Orders/invoices**
- ★ **Production control sheets**
- ★ **Operation sheets**
- ★ **Stores records**
- ★ **Accounts sheets**
- ★ **Bills of quantity**
- ★ **Statistics, reports, etc.**

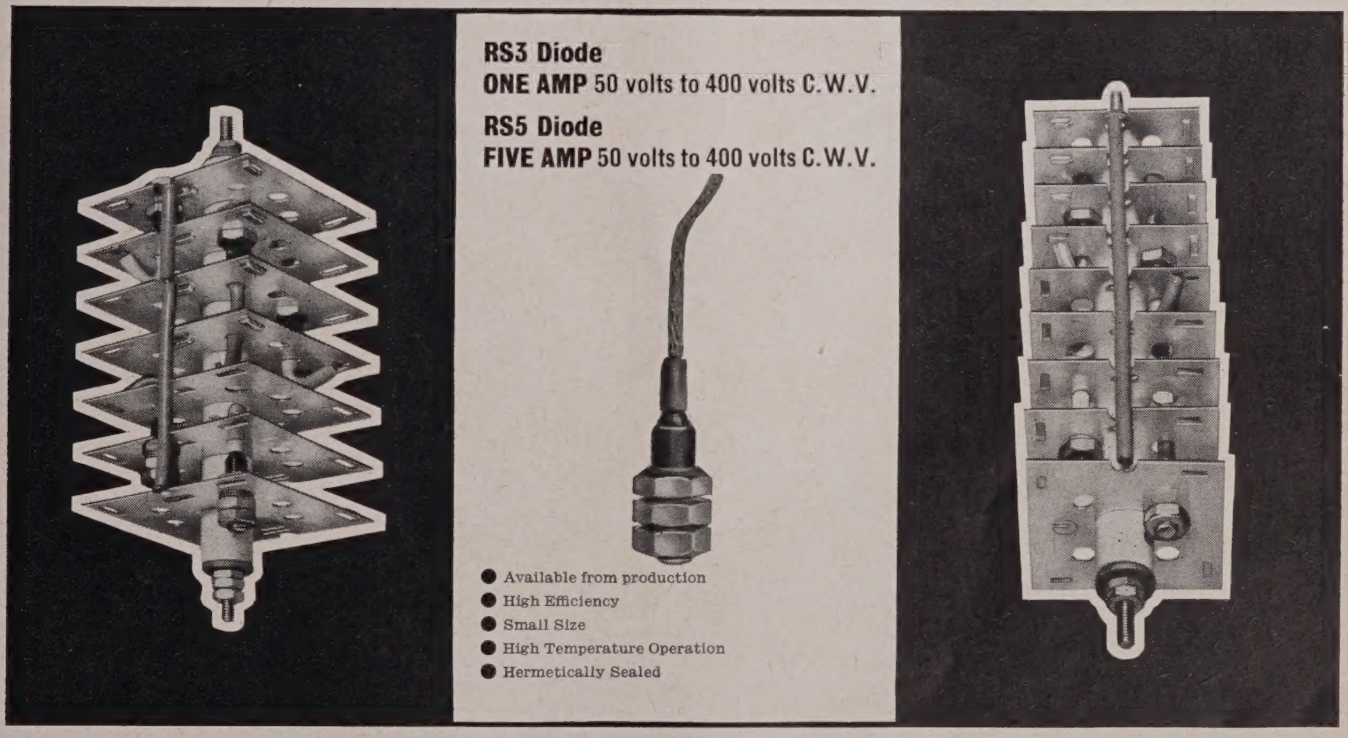
A 25-compartment Print Collator has been designed for operation with the ILFORD Azoflex 155. Both are available for outright purchase or on hire. The Azoflex system does not use ammonia and is glare-free. Azoflex dyeline papers and machines are the finest and fastest in Britain today.

ILFORD *Azoflex*

Write for full details of the ILFORD Azoflex range of dyeline printing papers and machines from

ILFORD LIMITED · INDUSTRIAL SALES DEPARTMENT AZ26F · ILFORD · ESSEX

SenTerCel RS3 and RS5 silicon power diodes and rectifier stacks



Rectifier Stacks

The design of SenTerCel Silicon Rectifier Stacks offers many advantages including small size, low weight and higher ambient operating temperatures (up to 100°C). At present, silicon stacks are supplied with half-wave, bridge or push-pull connections for either single-phase or three-phase inputs. The great variety of possible series and parallel connections between diodes provides an extensive range of voltage and current outputs.

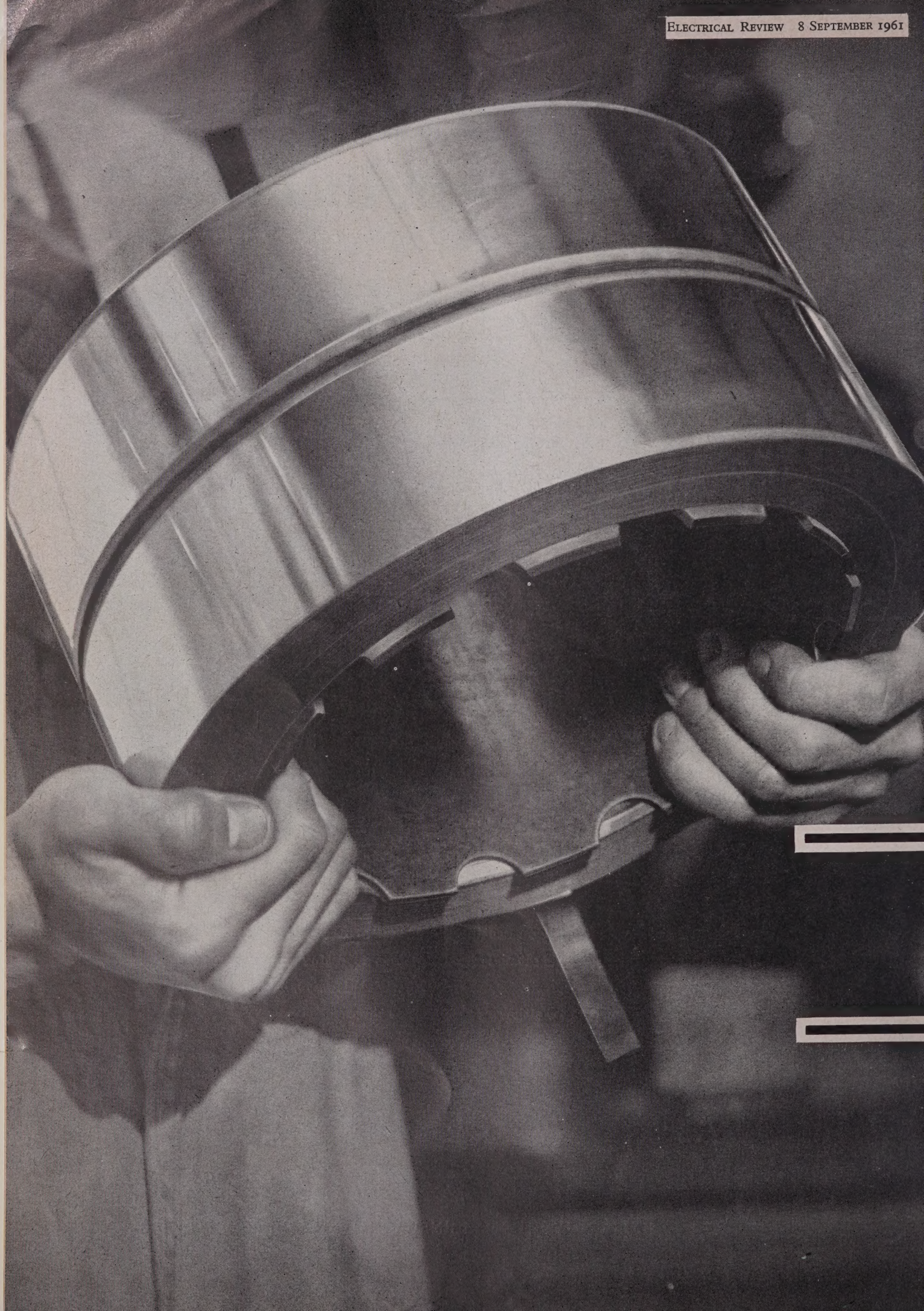
Write for STC silicon rectifier technical literature:

STC COMPONENTS GROUP

61/12MF

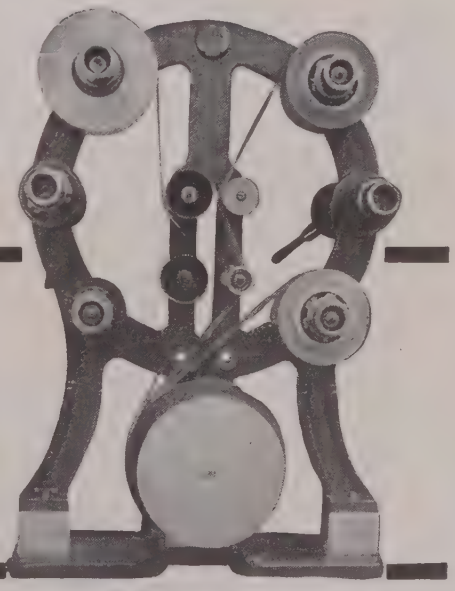
Standard Telephones and Cables Limited

RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX



This transformer coil costs less, weighs only half as much– it's wound with **aluminium strip**

Coils wound with aluminium strip not only have better electrical and thermal characteristics: they are simple to make and show appreciable savings in material costs. Because they have none of the air spaces unavoidable with round wire, they are generally no larger than wire-wound coils of equal power and weigh only half as much. If you would like to know more about strip windings, or other uses of aluminium in the electrical industry, get in touch with any of the Alcan Industries' offices listed below.



SIMPLE TO MAKE

The winding technique is very simple, needing no costly winding equipment with traversing gear. The coils can be wound on to their cylindrical formers without flanged bobbins. Service and advice are freely available to firms interested in strip winding techniques.

ALCAN INDUSTRIES LTD

A member of the ALUMINIUM LIMITED OF CANADA group of companies

FORMERLY NORTHERN ALUMINIUM CO. LTD

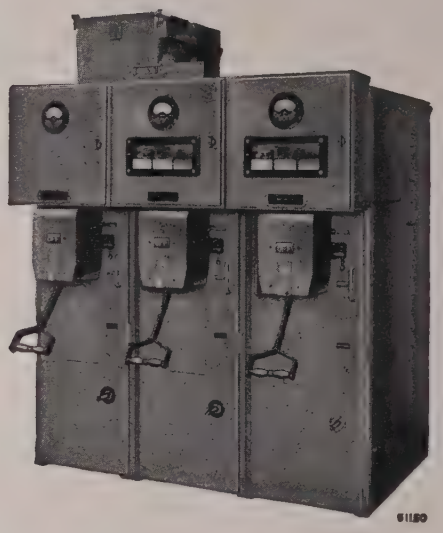
Makers of Noral Alloys

ALCAN

Sales Offices: **BELFAST:** Donegall House, 7 Howard Street. Belfast 32805 · **BIRMINGHAM:** Devonshire House, Great Charles Street 3. Central 7393 · **BRISTOL:** Peloquin Chambers, 18 St. Augustine's Parade 1. Bristol 20351 · **GLASGOW:** 73 Helen Street, Govan SW1. Govan 3693 **LEEDS:** 26-27 Park Row 1. Leeds 33621 · **LONDON:** 50 Eastbourne Terrace, W2. Paddington 3281 **LUTON:** 57 Bute Street. Luton 7364-5 · **MANCHESTER:** 23 Princess Street 2. Central 9335 **NEWCASTLE UPON TYNE:** Groat House, Collingwood Street 1. Newcastle 20878 **Castings & Forgings Sales Division:** Middlemore Road, Handsworth, Birmingham. Northern 3671

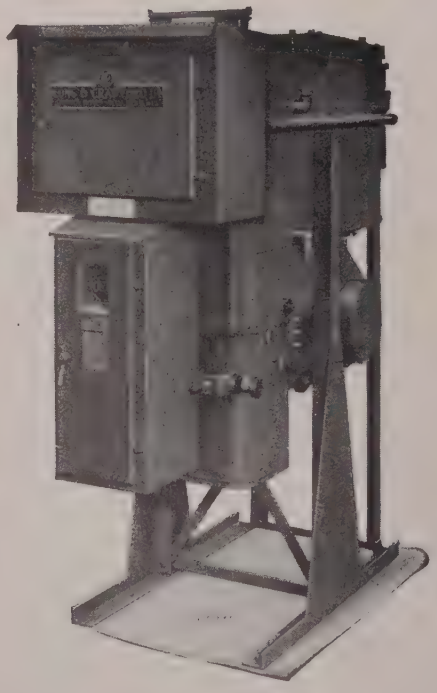
TBW/N61

CIRCUIT BREAKERS



INDOOR UNITS

ALD range of indoor vertical isolation air-insulated Circuit Breaker Units. Current rating up to 1,200 amps. Rated breaking capacities up to 350 MVA at 11 kV, 250 MVA at 6.6 kV and 150 MVA at 3.3 kV. Fitted with Hand, Spring or solenoid power-closing mechanism.



OUTDOOR UNITS

WPD range of outdoor oil and compound filled Circuit Breaker Units. Current ratings 400/800 amps. Tested fault ratings: 350 MVA at 11 kV and 250 MVA at 6.6 kV. Spring, Hand or solenoid mechanisms.

LONG & CRAWFORD LTD.

GORTON ROAD, MANCHESTER 12

you have never seen OFFICE LIGHTING like this before . . .



Pleasant working environments with accompanying efficiency call for reasonably high levels of illumination—but such high level illumination must be free from discomfort glare.

Merely to increase the light source brightness results in excessive glare from the lighting fitting. The answer is low brightness fittings of high luminous output—"Comfort in Lighting" fittings developed by G.E.C.

The G.E.C. range of "Comfort in Lighting" fittings is the only one which meets the recommendations for every type of installation of the new Code for Good Interior Lighting issued by The Illuminating Engineering Society.

You could see lighting like this every day in *your* office, by installing G.E.C. "Comfort in Lighting". Write for the 40 page illustrated brochure F4695 or better still, ask us to send a Lighting Engineer. Our Lighting Advisory Service is entirely free and without obligation.

comfort in lighting

means high level illumination without discomfort glare.

G.E.C.

LIGHTING & HEATING GROUP

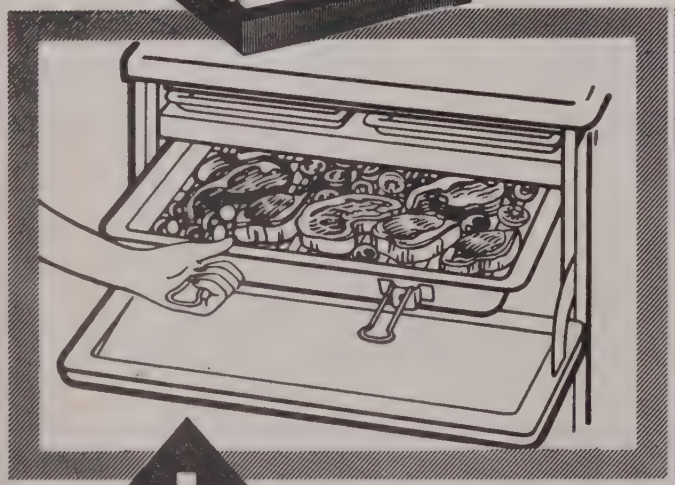
LIGHTING AND HEATING GROUP · THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

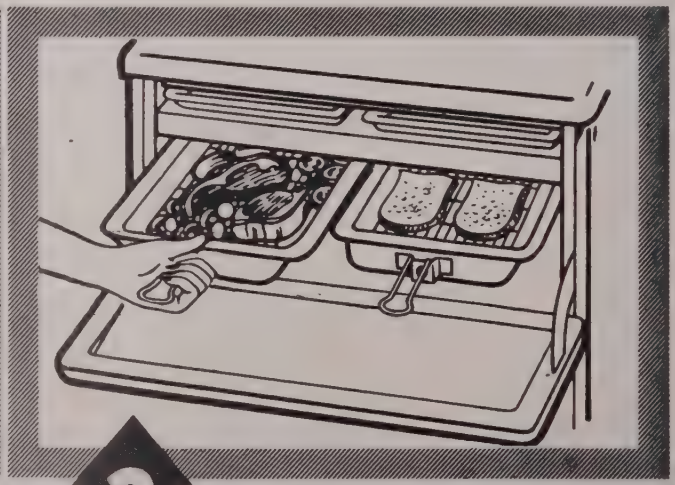
Only Belling give you a choice of grill pans



Now you can have two separate grill pans with the Classic Sixty. By the addition of a simple fitment, the standard cooker can be converted to take two 10½″ x 8″ grill pans instead of the famous 10″ x 16″ when the latter is not required. Here is a selling feature that every housewife will appreciate as soon as she sees it. She can use the big "double" grill for large family meals—it will take even the largest fish in one piece —or she can use the smaller pans for small quantities or for cooking two different meals at the same time (bacon and tomatoes in one and toast in the other, for example). The Classic Sixty grill is not only versatile but *economical* as well. The element is wired in two halves. Turn the control knob one way and both halves are on; turn it the other way and only one half is on.

What does it cost? The standard Classic Sixty is still £69.10.0 complete with the big "double" grill pan. The small grill pans cost 11/5 each extra, plus 7/6 for the special central runner fitment.





USE 1 LARGE PAN....OR 2 SMALL GRILL PANS

Just to remind you, here are only some of the other exciting features of the Classic Sixty • **Easy-set Auto-Timer; electric clock and ringing timer too** • **Indicator lights on all controls (nothing left on accidentally now)** • **Four radiant plates** • **large independently-heated hotcupboard** • **slide-out oven roof and one-piece lining** • **Wheels for easy moving, with automatic brake**

"Belling" CLASSIC SIXTY

BELLING & CO. LTD., BRIDGE WORKS, ENFIELD, MIDDX.

CRC/BET/488

IT REALLY STANDS OUT

(There are 273 feet of it)*



*

Add a hundred feet or so to Nelson's Column and you have the height of the famous Morgans chimney at Battersea. Surprising what a little investigation can bring to light. Take what is produced at the foot of the chimney—take MORGANITE carbon. Carbon in ships, carbon in trains, carbon in motor cars, carbon in aircraft; carbon in electrical generation; carbon in current collection; carbon in washing machines and vacuum cleaners; carbon in telephones, pumps, radios and refrigerators; atomic carbon, mechanical carbon, electrical carbon—always carbon is somewhere at work. In the last fifty years, we have put carbon on the map. We have adapted it to the needs of so many industries that now our MORGANITE carbon products are known throughout the world. Their quality, reliability and consistency are outstanding.

Morganite Carbon Limited

A Member of The Morgan Crucible Group

Battersea Church Road, London, S.W.11
Battersea 8822

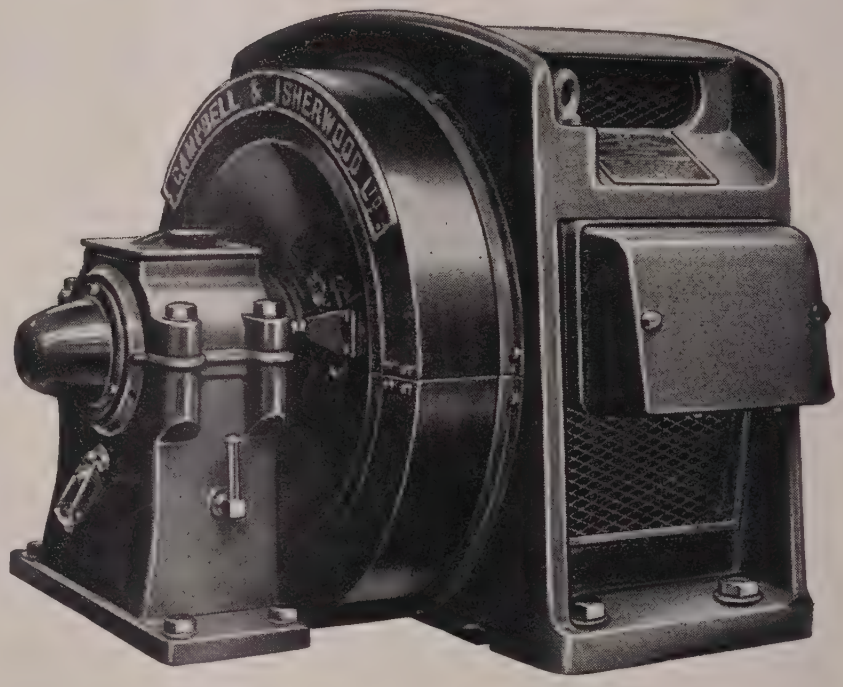
C62A/797

INDUSTRIAL ALTERNATORS

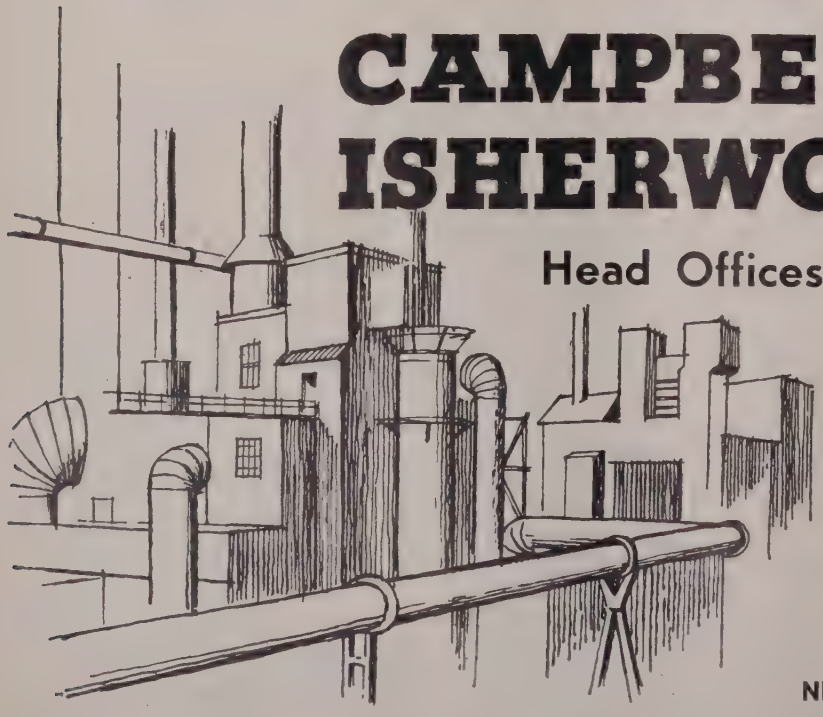
★ CONSTRUCTION
Robust Electrical and Mechanical construction, with Enclosures as required to suit site conditions.

★ EXCITATION
Static, super excitation or single exciters as necessary to deal with load and time response requirements.

★ INSULATION
All grades of insulation are available as required by ambient and operating conditions.



★ Complying fully with B.S.2613, or clients' special specifications.



We also manufacture D.C. Motors, Generators, Switchboards Special Fittings, Geared Couplings, High Ratio Gear Boxes Machine cut gears

CAMPBELL *and* ISHERWOOD LTD.

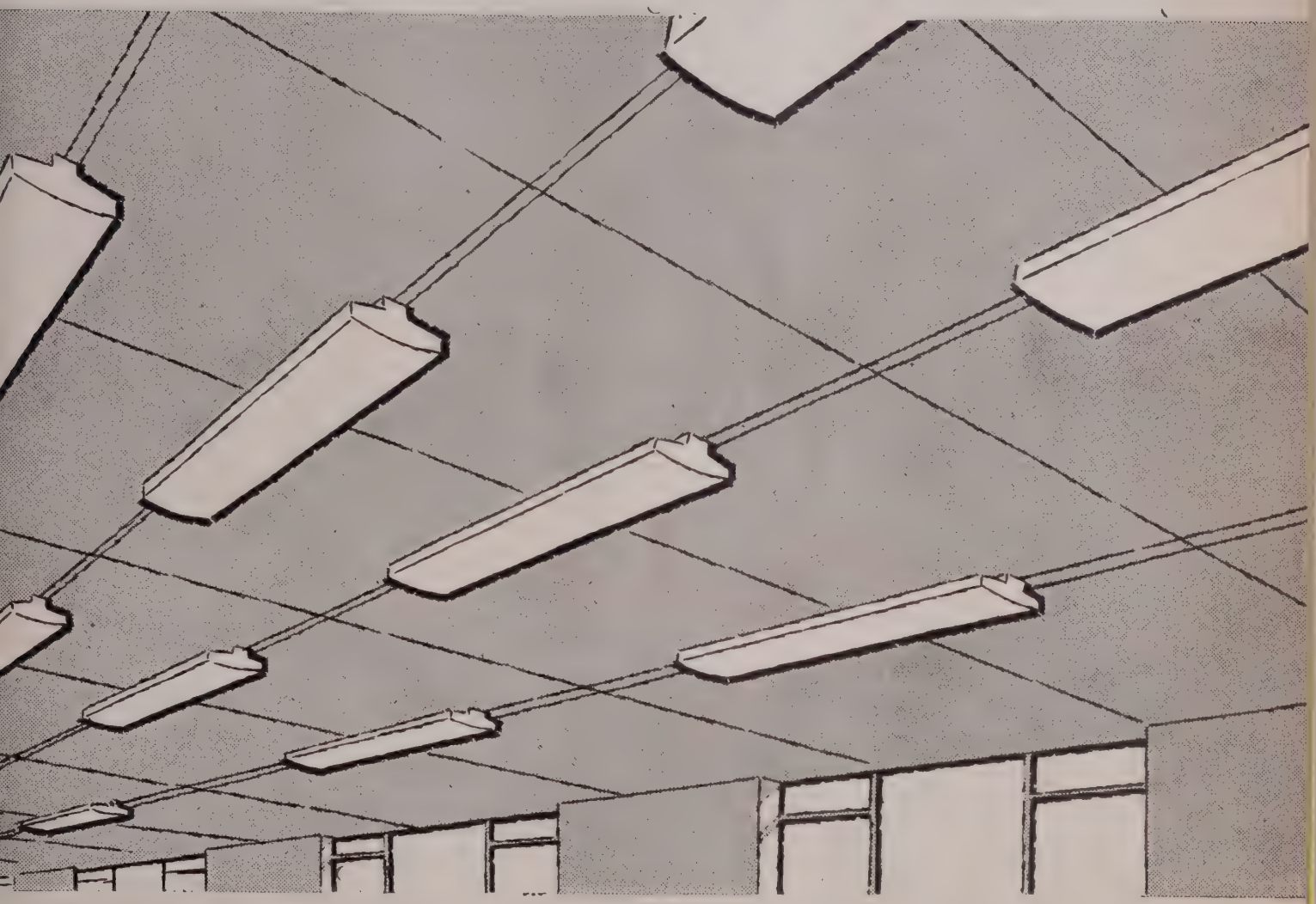
Head Offices **PENPOLL WORKS**
HAWTHORNE RD.
BOOTLE LIVERPOOL 20

Phone **BOOTLE 4641**
Grams **PRESSURE**

Branches at:—

NEWCASTLE GLASGOW
LIVERPOOL LONDON
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UNISTRUT
TRUNKING
FOR CHEAPER AND NEATER LIGHTING INSTALLATIONS



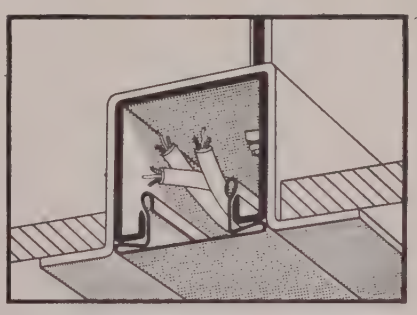
THE UNISTRUT SYSTEM provides the cheapest and simplest method of installing lighting units. UNISTRUT is rapidly and easily assembled, thus reducing on-site costs and time, and it ensures perfect alignment, even when butted to form continuous runs. UNISTRUT trunking accepts most types of fluorescent or tungsten fittings anywhere along its length, and permits the re-arrangement of the lighting at any time.

Send now for comprehensive literature on UNISTRUT, the answer to your framing and support problems. Write to:—

UNISTRUT DIVISION OF SANKEY-SHELDON LIMITED

A MEMBER OF THE GKN GROUP OF COMPANIES

43-45 Broadwater Road, Welwyn Garden City, Herts.
Tel: Welwyn Garden City 26321 (4 lines)



UNISTRUT dual-purpose trunking

Where trunking and false ceilings are to be supported, the UNISTRUT 'Top Hat' section is simply placed over the top of the required length of basic UNISTRUT channel. This permits ceiling panels to be closely fitted to each side of the channel, which is itself left open until the wiring installation is completed. Closure is made by standard UNISTRUT closer strip which gives a neat, flush finish.

HORSTMANN TIME SWITCHES

automatically control

STREET LIGHTING

SHOP WINDOW LIGHTING

IMMERSION HEATERS

FACTORY YARD LIGHTING



* NEON SIGNS

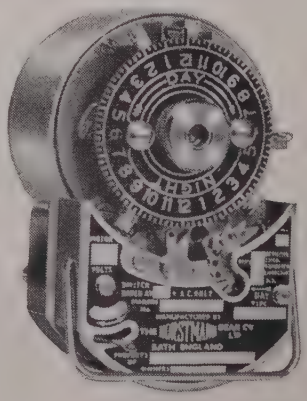
* NEON SIGNS | SPACE HEATING | OFF PEAK TARIFFS

Dusk means different things to different people. Romance. Food. The start of the night shift. Or . . . Frying 8 p.m.—Dolores Hair Fashions—Members Only—Hot Pies—Regency Bar—All Night Service . . . that's what dusk means to Horstmann. Why? Because controlling neon signs is just one of the many jobs performed by Horstmann Time Switches. Performed very efficiently too, for Horstmann have a reputation for accuracy all over the world. And reliable? Well, you can draw your own conclusions from watching the signs in *your* town come on at dusk . . . regular as Horstmann.

Some of the other electrical appliances controlled by Horstmann Time Switches are shown above. What we really need however is a neon sign stating "Impossible to show everything we do . . ." for there are Horstmann Time Switches for controlling practically any appliance that needs to be switched on and off entirely automatically without attention.

The Horstmann Type K Mark II Time Switch

is used extensively for controlling neon signs. The high precision synchronous motor driven movement has a capacity at 250 volts 50 cycles of 20 amps A.C. for tungsten loads. A selective device can be supplied to prevent operation on any specified day or days of the week. The unit is available in a neat moulded or metal box, or with a clear moulded push-on cover or with hinged drum cover. Please write for full details of the switch best suited to your particular requirements, giving as much information as possible about the application.



HORSTMANN

THE HORSTMANN GEAR COMPANY LIMITED

NEWBRIDGE WORKS · BATH · Tel: 7241

HG14

Electrical
September 1961

A NEW RANGE OF NEWMAN MOTORS

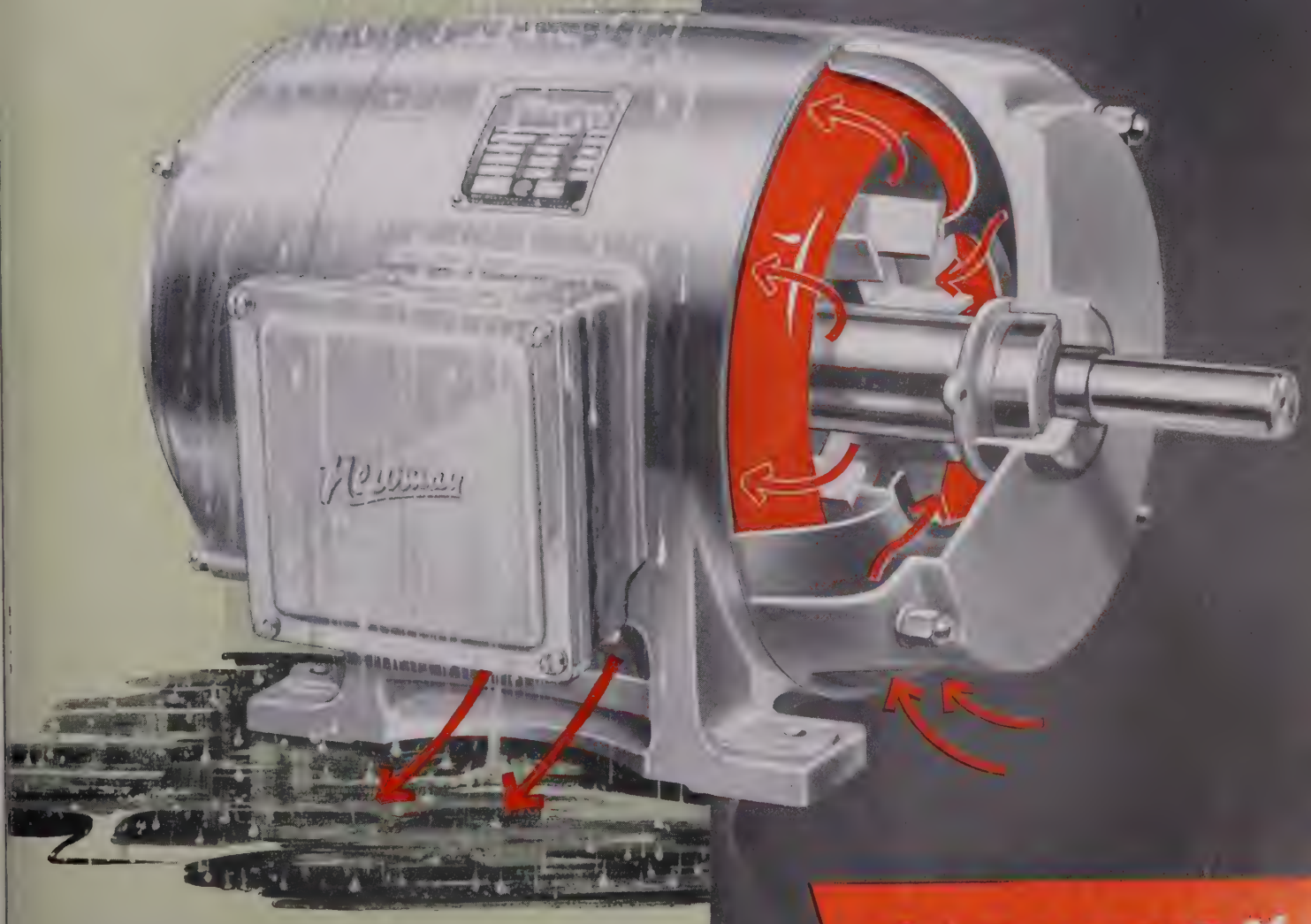
THE

Newman SEAL

'OPEN' MOTOR

Protected against damage by

WATER
OIL
CHEMICALS and
AIRBORNE ABRASIVES



An 'OPEN' motor for a totally enclosed application.....by

Newman

THE Newman SEAL 'OPEN' MOTOR

for use in applications where WATER, OIL, CHEMICALS or AIRBORNE ABRASIVES are present.

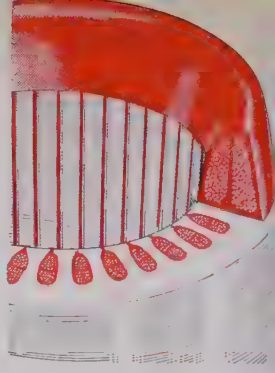
BETTER THAN TOTALLY ENCLOSED. Tests have proved that for many applications the 'NewmanSEAL' open motor is more satisfactory because an enclosed motor 'breathes' and so can suck in damaging fumes to make contact with the windings. Also the free circulation of air within the 'NewmanSEAL' motor prevents condensation troubles which are not uncommon in totally enclosed motors. ★

SPECIFICATION: Open (ventilated) 3-phase, squirrel-cage, 50 cycles, 650 volts maximum. Temperature rise 65°C, Class 'E' insulated. To BS2613:1957 NEMA Standard Dimensions. Range: ½ to 125 hp.



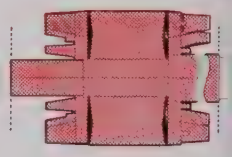
ENCAPSULATED STATOR WINDINGS

The resin, which has excellent dielectric qualities is applied in liquid form and penetrates deep into the windings, as this sectioned view illustrates. Also the stator bore is sprayed with resin to help protect the laminations against corrosion.



RESIN PROTECTED ROTOR

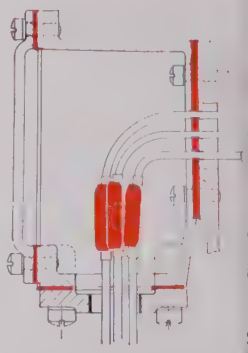
The rotor is sprayed with resin to help protect the 'open' surfaces against corrosion.



SEALED TERMINAL BOX

Wide flanges and the use of gaskets between all joints ensures positive sealing. Also the opening between the terminal box and the inside of the motor is specially sealed.

LOOSE LEADS – The motors have loose leads instead of a terminal block so that joints of the incoming cables can be taped to make damp-proof joints.



This illustration of the stator winding shows how the encapsulation completely covers and protects the coils. The formulation of the resin used gives a hard positive protection against mechanical damage and yet is resilient enough to withstand repeated expansion and contraction of the windings over their normal operating temperature range.

★ *The 'NewmanSEAL' motor is not intended to replace our totally enclosed motors for applications where excessive dirt or solid masses are likely to clog the air gap – for such conditions we can supply an enclosed motor with the added protection of the 'NewmanSEAL' motor.*

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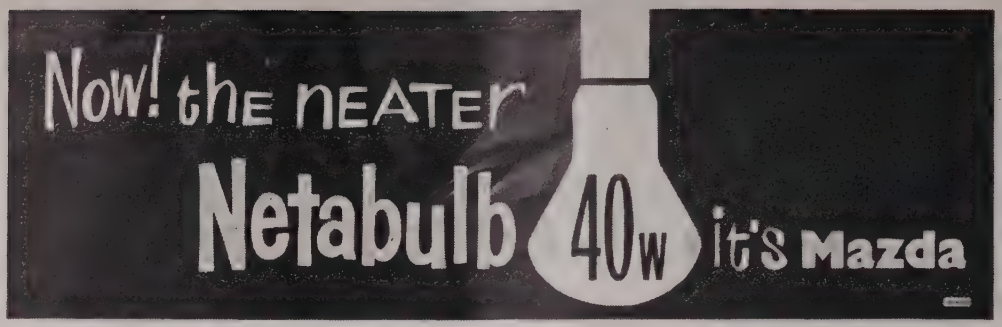
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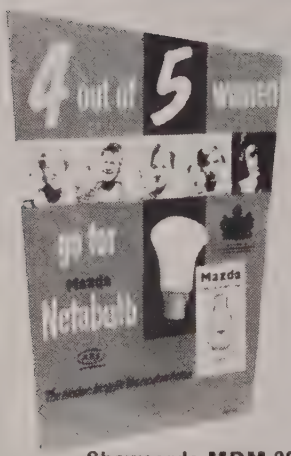


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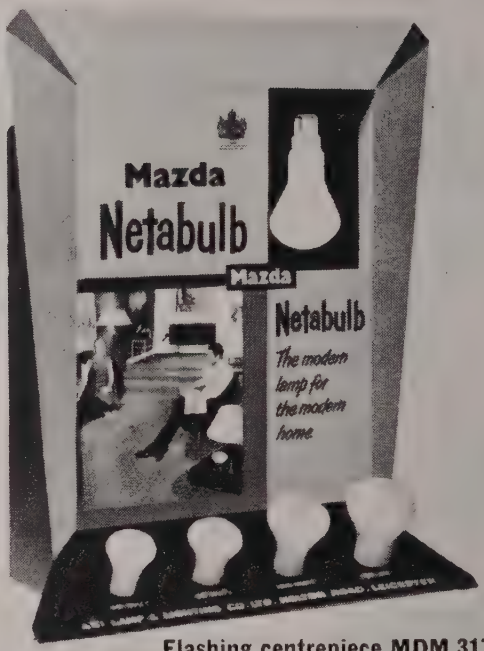
Banner MDM 336



Showcards MDM 321
and MDM 331



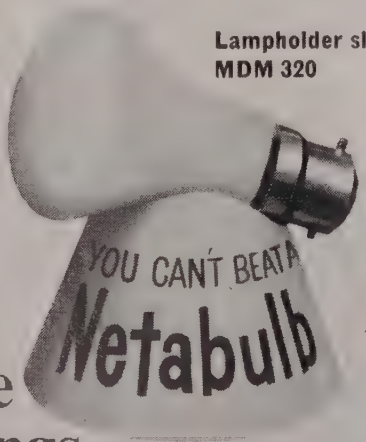
Booklet AL 238A



Flashing centrepiece MDM 317
(window-dressing only)



Lampholder sleeve
MDM 320



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4-lamp pack MDM 286

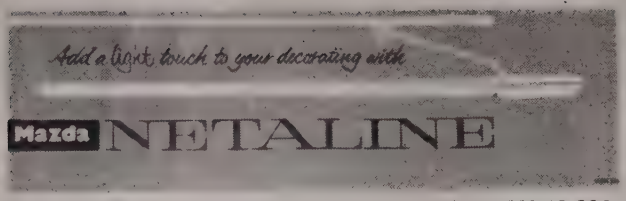
Mazda advertising lights up

FOR NETABULB there'll be 15-second spots on all TV stations from the end of August to the middle of November.

FOR NETALINE there'll be 60-second participation in TV advertising magazines during September and October. *And* full-page advertisements in home-interest magazines from September to November, inclusive.

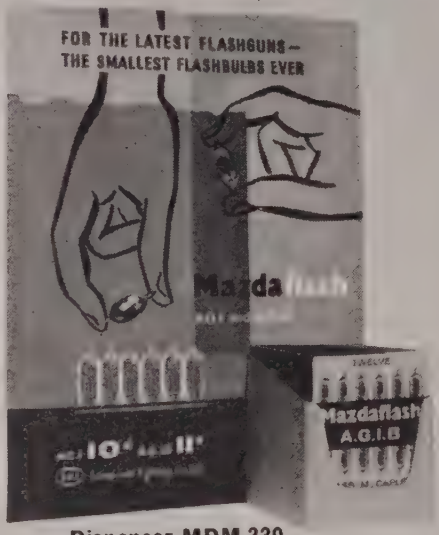
FOR MAZDA DECORATION SETS there'll be participation in TV advertising magazine programmes during December—in good time for Christmas buying.





Pelmet MDM 324

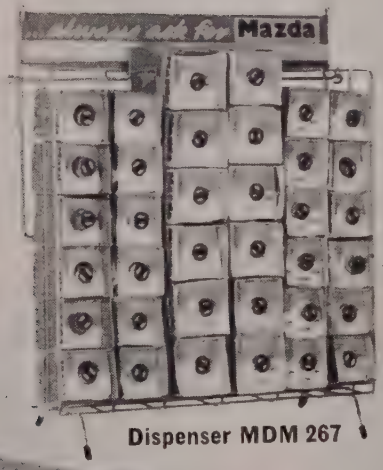
Showcard MDM 309



Dispenser MDM 330



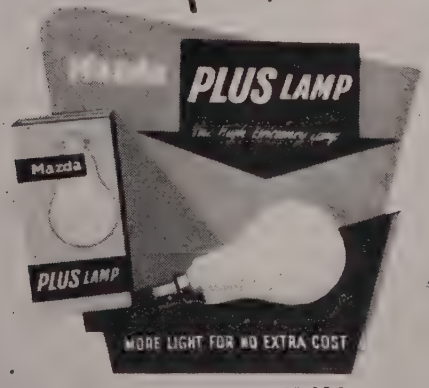
Pelmet MDM 325



Dispenser MDM 267



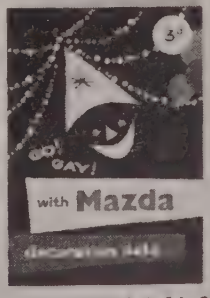
Pelmet MDM 323



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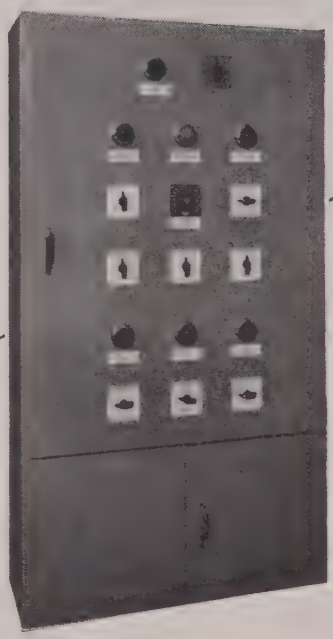
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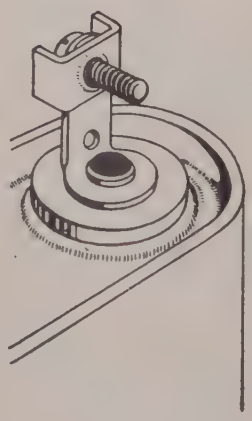
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D.C. Test = A.C. Wkg volts x 3
To Earth, A.C. wkg volts + 1,000 volts A.C. or 2,000 volts A.C. min
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Capacitance Tolerance: Standard limits as shown. Others by arrangement
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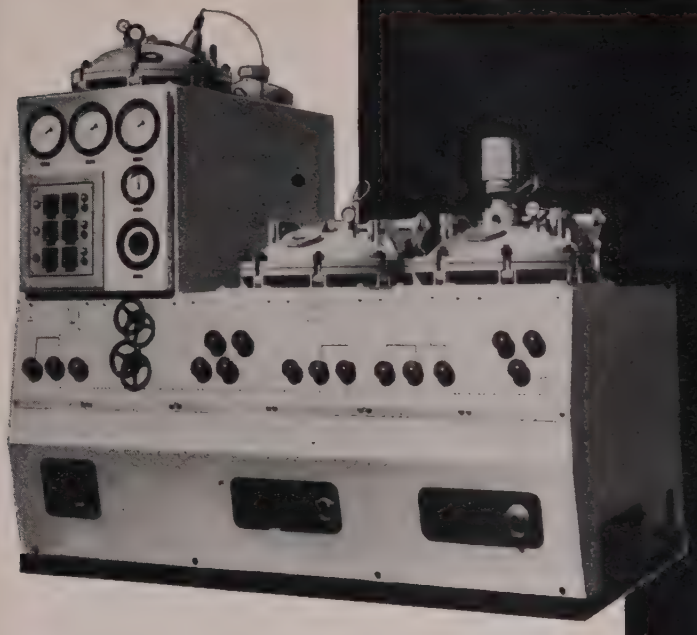
TYPE L89/1 STANDARD RANGE

Capacitance μF	Volts A.C. wkg.	List No.	Dimensions—inches	
			Length	Cross section of all units
3.2 min	250	ZG101	2	2.148 x 1.398
4 min	250	ZG102	2¼	
5 min	250	ZG103	2⅝	
6 min	250	ZG104	3	
7.4 min	250	ZG105	3½	
3.5±5%	400	ZG106	3¼	
6.8±5%	400	ZG107	5⅝	

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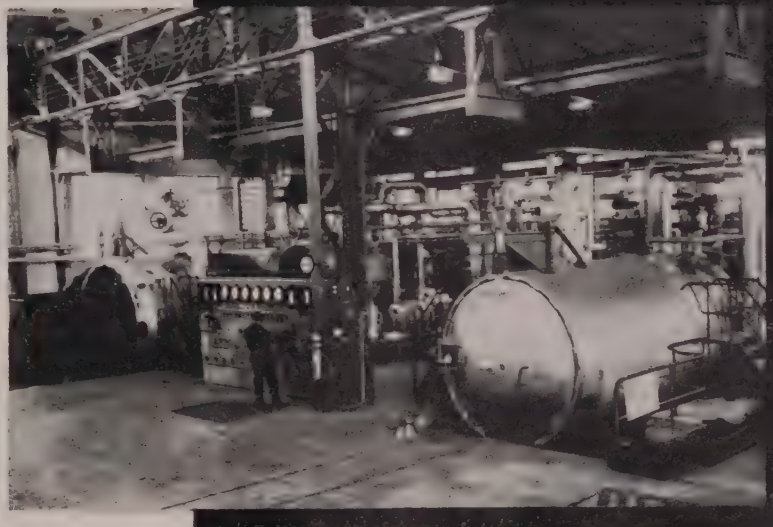
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Right : Compound impregnation plant with two horizontal impregnation tanks and centrally located control panel.



Below : A complete "Speedivac" impregnation installation for the production of power capacitors.



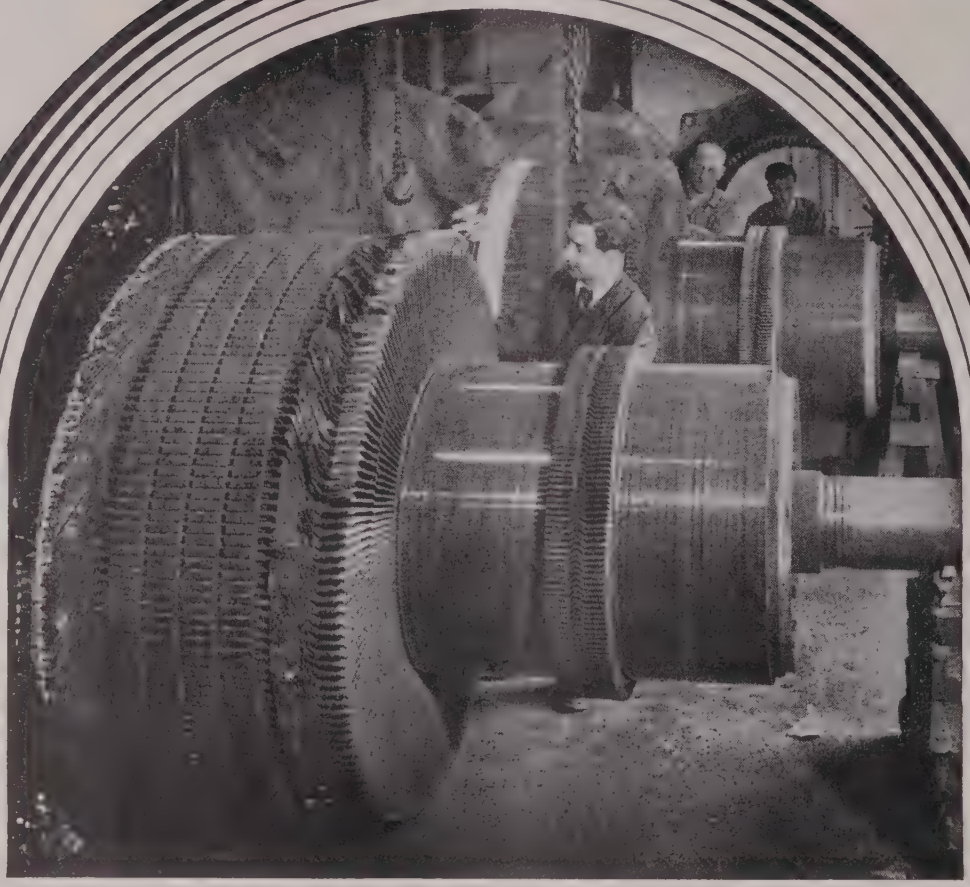
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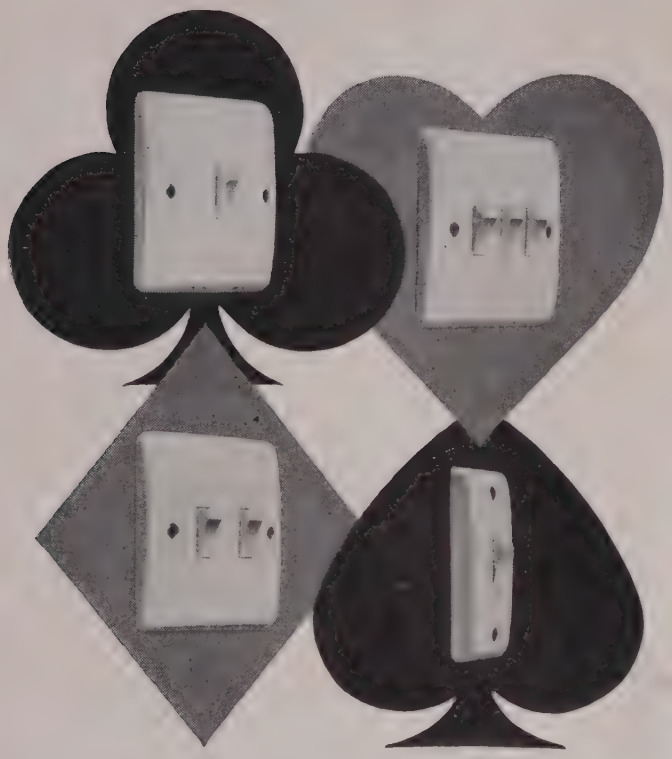
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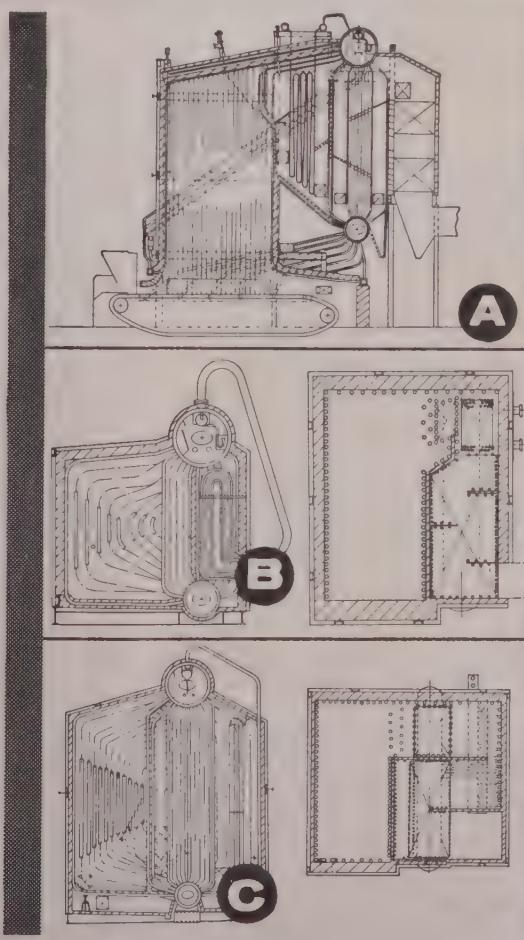
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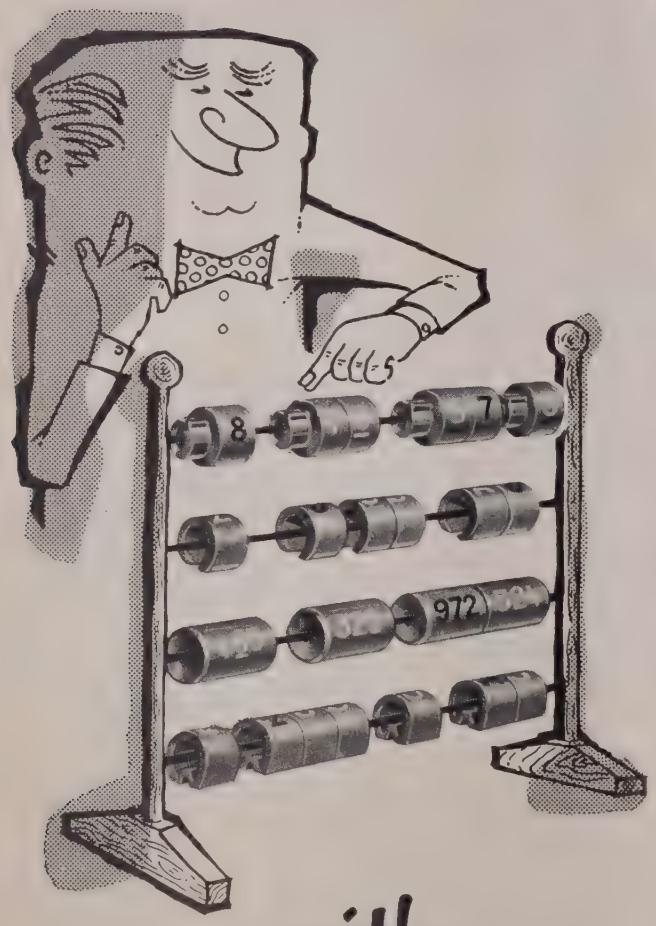


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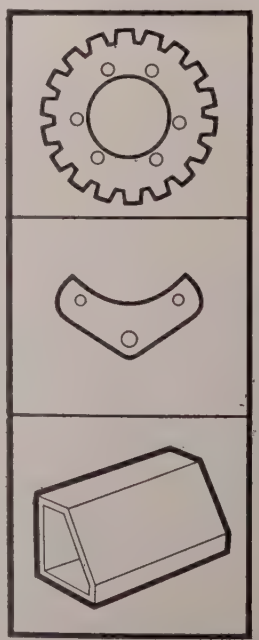
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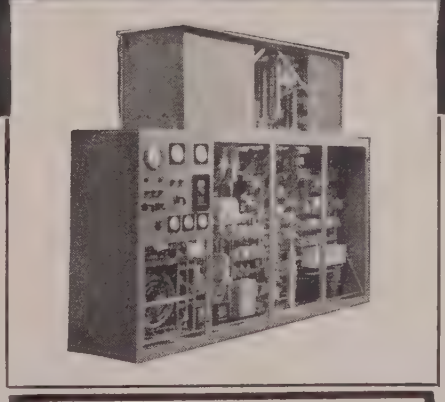
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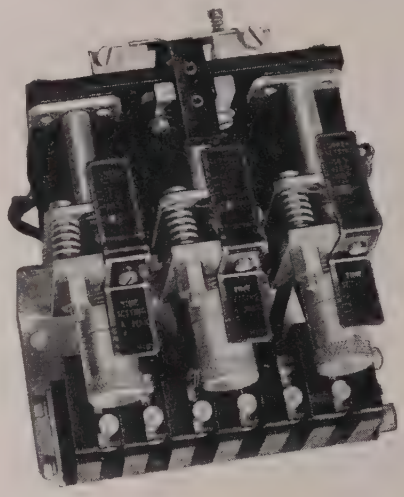
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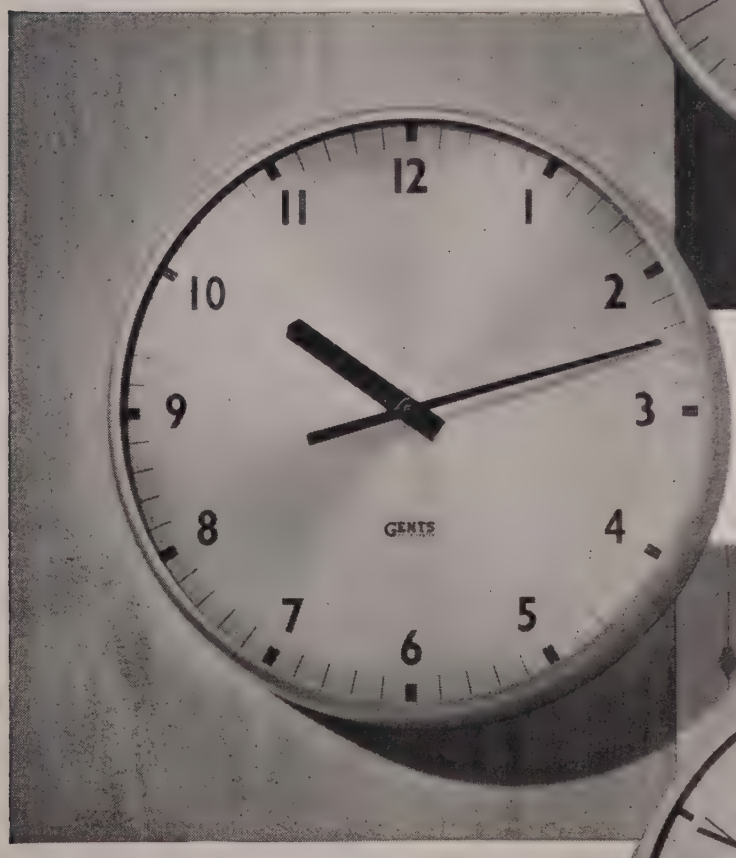
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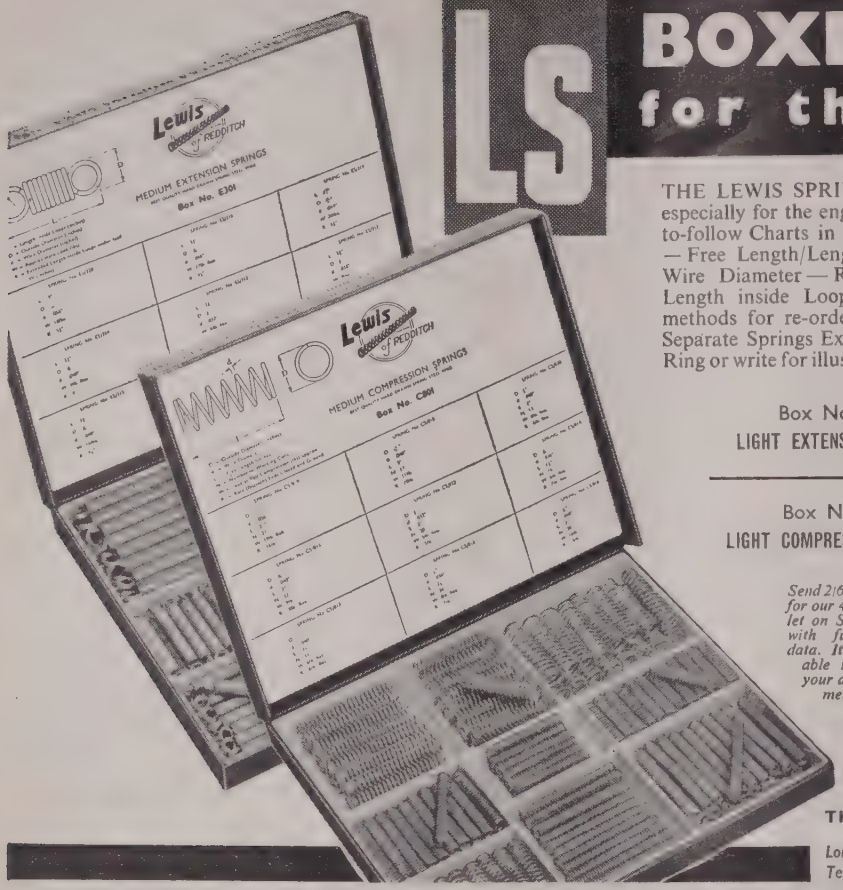
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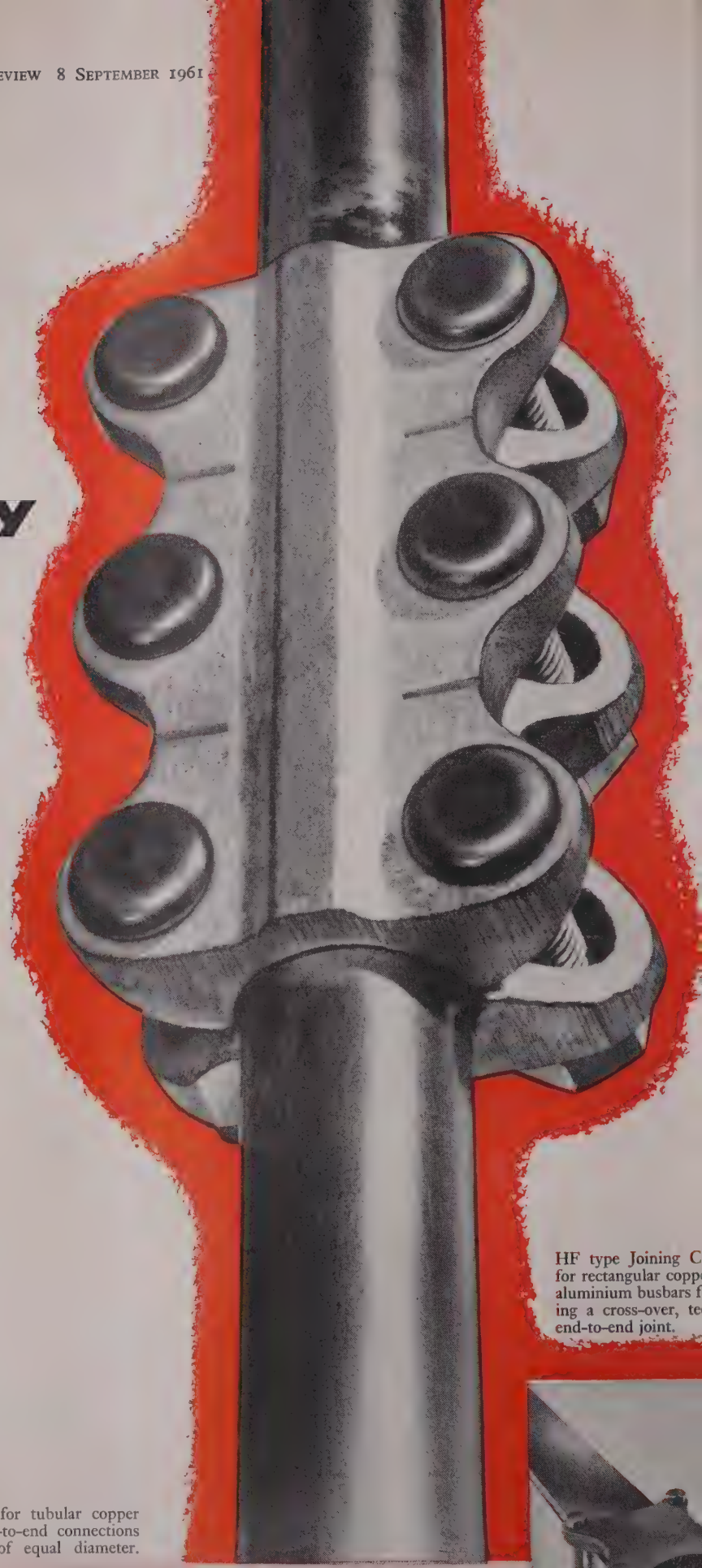
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for every type of copper or aluminium installation

This comprehensive range of fittings includes all types of connectors, supports, clamps, and taps for tubular, rectangular, angle and channel busbars, stranded conductors and studs.

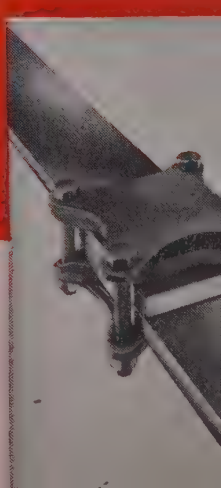
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Coupler type NS for tubular copper busbar. Rigid end-to-end connections between busbars of equal diameter.

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B·D·H

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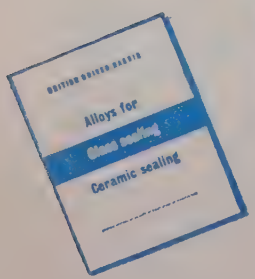
No. 4 Alloy. Used in the radio valve industry for contact pins in moulded glass bases, and also for the sealed-in buttons in cathode ray tubes. It can be used without copper coating with soft glasses of the lead silicate type.

48% Nickel-Iron. The coefficient of expansion of this alloy is approximately equal to that of soft glasses such as soda-lime and lead. It is therefore used over a very wide field; radio valves and mercury vacuum switches are examples. This alloy has the high susceptibility needed for low wattage relays or pick-ups, and its negligible core loss is useful in high-frequency transformers or relays.

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Special Compositions. We welcome being put on our metal—in every sense.

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The custom-built Triple Frequency Generator supplied for the Trinity House Experimental Station at Dungeness is yet another example of Electro-Dynamic special purpose equipment. This generator is used for energising experimental fog-signalling equipment. It comprises three alternators in a common casing, having 16, 22 and 28 poles respectively and is driven by a 2-pole induction motor, through a magnetic-particle type coupling and flywheel.

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Rotary convertors	Voltage stabilisers
Flame-proof marine motors	Rotary transformers
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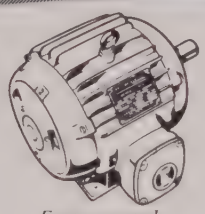

No other
INDUCTION MOTOR
MADE IN GREAT BRITAIN

STANDARD MOTOR HAS ALL THESE FEATURES

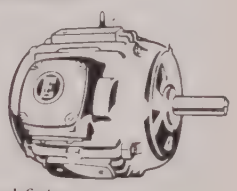
- ★ Totally-enclosed, fan-cooled, to BS 2960 Part 2
- ★ Cast iron exterior
- ★ Non-corrodible polyester resin external fan
- ★ Drain holes with removable plugs
- ★ Provision for earthing terminal
- ★ Unified threads throughout
- ★ Weatherproof-type terminal box with 4-screw fixing
- ★ Rating plate with full details including bearing sizes and grade of grease
- ★ Class E insulation for 65°C temperature rise
- ★ All 'D' type motors can be designed to accept plugging switches, trifurcating boxes and all standard fitments

Other 'D' type motors available:

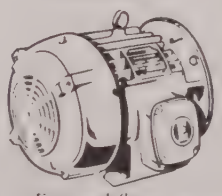
- ★ Chemical Works and Gas Works motors
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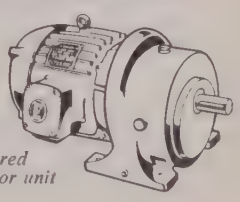
Foot mounted



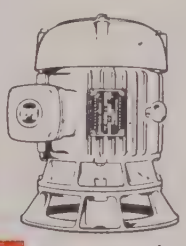
Pad fixing



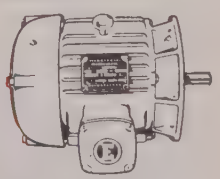
Foot and flange mounted



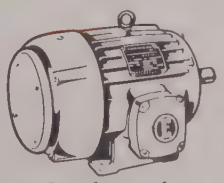
Geared motor unit



Skirt mounted



Flange mounted



Lint-free cowl

'ENGLISH ELECTRIC'

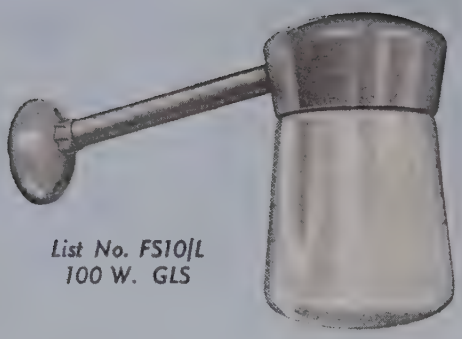
TYPE 'D' MOTORS

INDUSTRIAL MACHINES DEPARTMENT, PHOENIX WORKS, BRADFORD

The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

DM. 90

Join the users of these SMART SETS and cut installation costs too!



List No. FS10/L
100 W. GLS



List No. FS10/C
100 W. GLS



List No. FS10/S
100 W. GLS

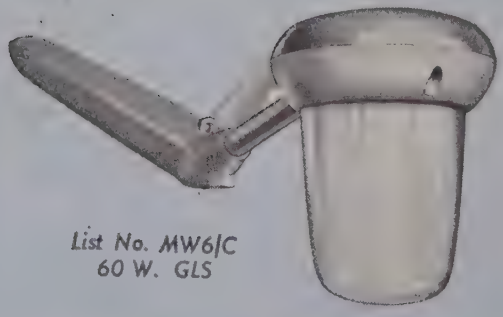


List No. MW6/L
60 W. GLS

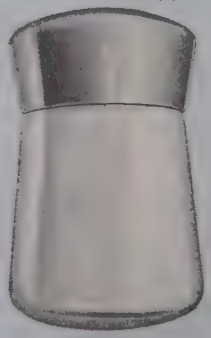


List No. MW6/S
60 W. GLS

Also as Single units
Tapped ¾" E.T. at top



List No. MW6/C
60 W. GLS



List No. FS10/T
100 W. GLS



List No. MW6/T
60 W. GLS

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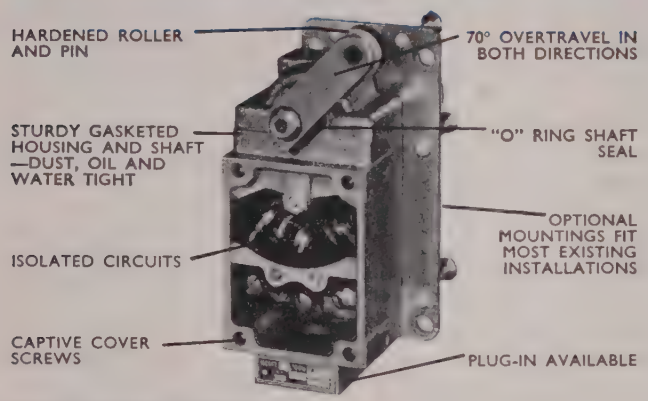
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STANDARD OF RELIABILITY

in limit switches for machine tools and handling equipment

MODEL L100W *heavy duty*



HIGH CONTACT PRESSURE Twice as much contact pressure.

LONG CONTACT LIFE Lowest impact, minimum "bounce". Weight of contact units (mass at impact) 2.45 grams.

70° SAFETY OVERTRAVEL

WATER, DUST AND OIL TIGHT

MEDIUM OPERATING FORCE Greatly reduced wear.

SIMPLICITY OF DESIGN Ease of maintenance, few working parts.

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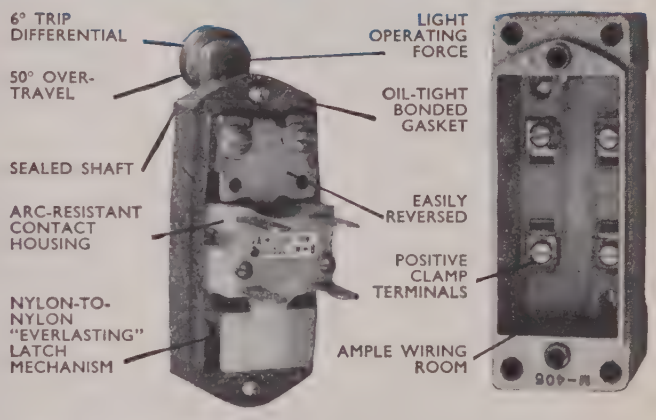
LEVERS 150 levers available.

45 CONTACT ARRANGEMENTS

AMPERE RATINGS

	Normal		Inrush
VOLTS	AC	DC	AC
125	30	5	60
250	15	2	30
Three circuit switches rated to 300 volts only Two circuit switches rated to 600 volts			
500	7.5		15
600	6	.4	12

MODEL M *precision*



LONG MECHANICAL LIFE Heavy duty nylon latch mechanism. Tested to 45,000,000 cycles under electrical load.

WIDE CONTACT GAP

FULLY ISOLATED CIRCUITS Positive double break, 1-NO, 1-NC.

50° OVERTRAVEL In both directions, only 6° trip differential.

MANY LEVER STYLES Wide choice for maximum adaptability.

PLUG-IN MODELS

AMPERE RATINGS

	Normal		Inrush
VOLTS	AC	DC	AC
125	20	3	60
250	15	1.5	30
500	7.5		15
600	6	.4	12

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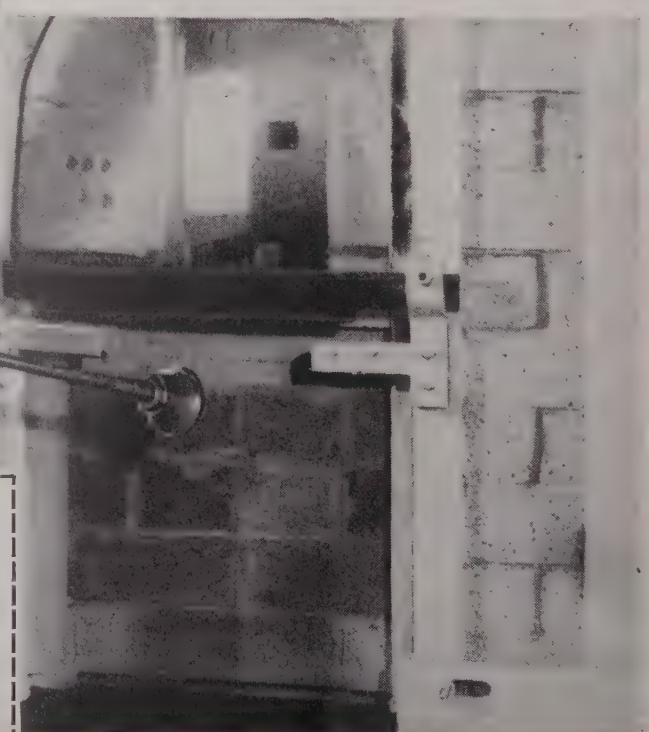
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Sodium discharge lamps need high purity glass to resist attack by sodium vapour. AEI Glassworks solved their problem of keeping out impurities by building this platinum-lined furnace.

Platinum Metals have exceptional chemical inertness and superior wear resistance. Furnace and furnace components lined with a platinum alloy do not contaminate the product, have a long life and a high recovery value.

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A platinum metal may be the *cheapest* answer to a heat or corrosion problem.

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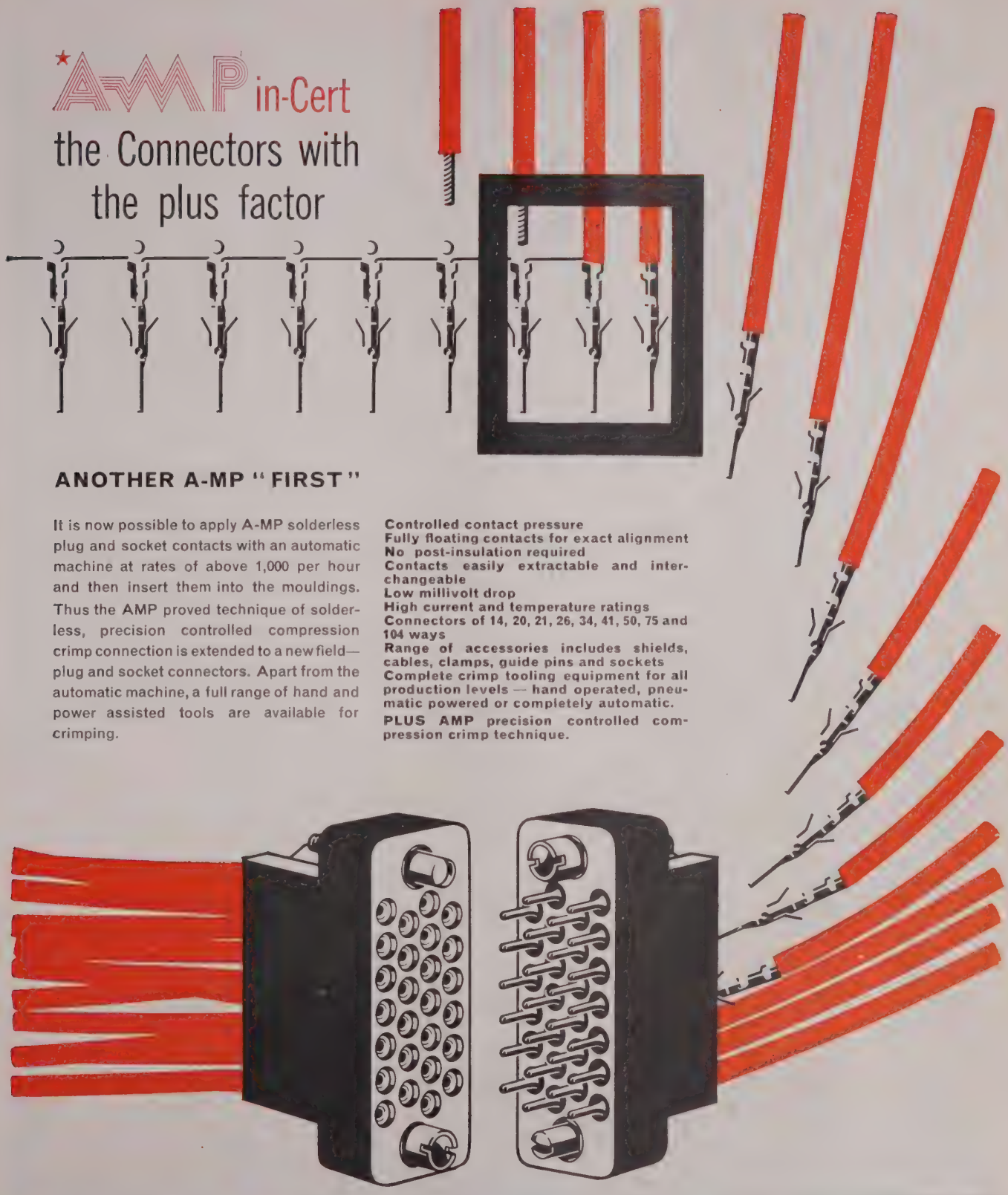
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the Connectors with the plus factor



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Controlled contact pressure
Fully floating contacts for exact alignment
No post-insulation required
Contacts easily extractable and interchangeable
Low millivolt drop
High current and temperature ratings
Connectors of 14, 20, 21, 26, 34, 41, 50, 75 and 104 ways
Range of accessories includes shields, cables, clamps, guide pins and sockets
Complete crimp tooling equipment for all production levels — hand operated, pneumatic powered or completely automatic.
PLUS AMP precision controlled compression crimp technique.

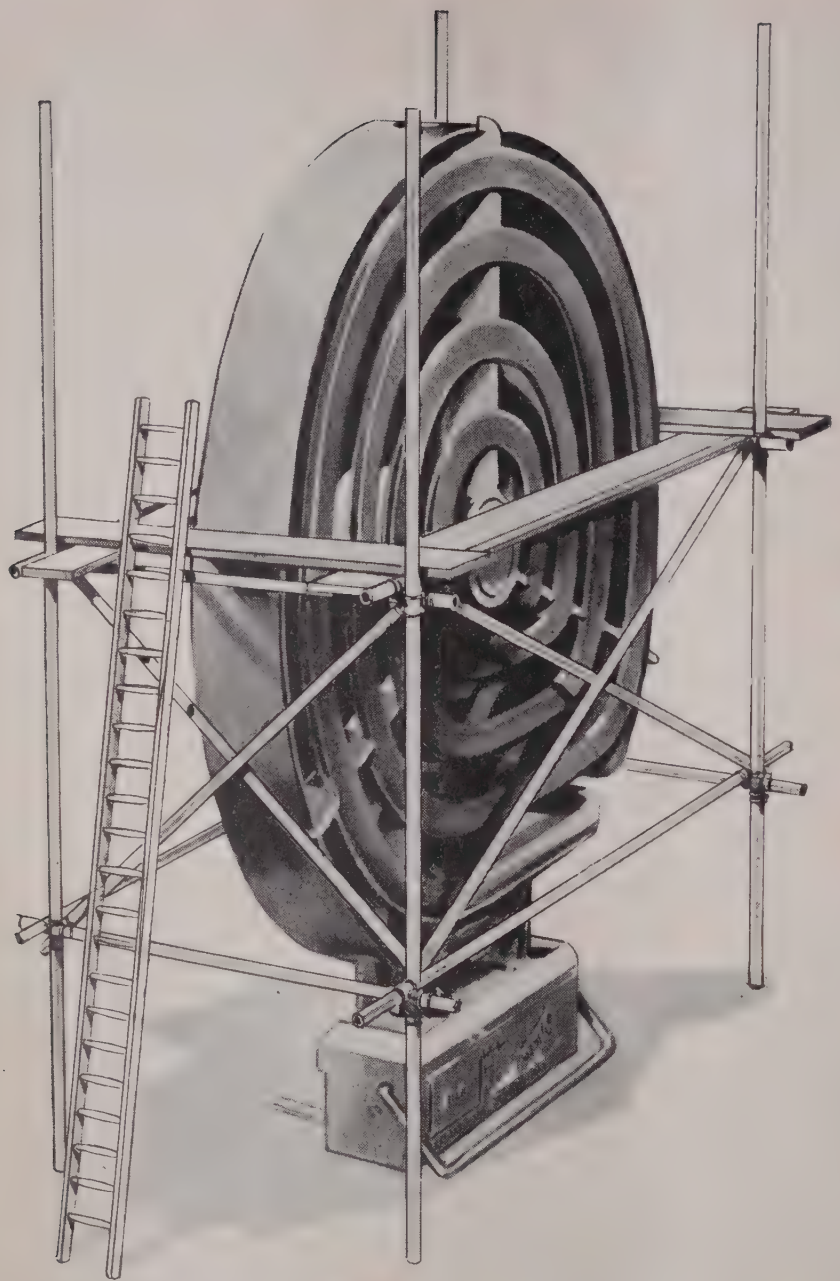
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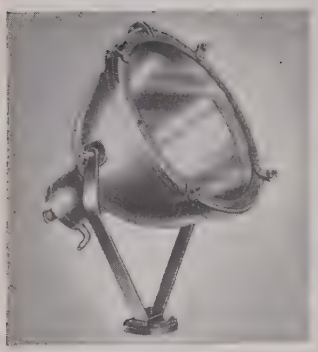
. . . a complete range of standard motors and starters

Including British Standard ventilated 'C' frame (to B.S. 2960) and totally enclosed 'B' (to B.S. 2083) and 'D' frame (to B.S. 2960 pt. 2) motors. Matching direct-to-line (non-reversing and reversing) and star-delta starters.

456

THE GENERAL ELECTRIC CO LTD OF ENGLAND • ENGINEERING GROUP • ROTATING PLANT DIVISION • BIRMINGHAM 6

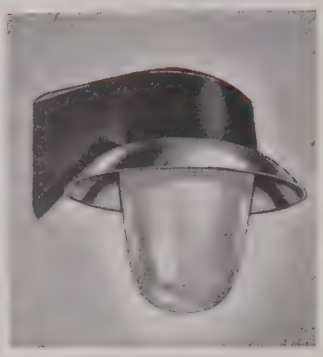
. . . for Lighting, for Switchgear for quality, for service, choose Simplex



The Simplex General Purpose Floodlight Projector is available in narrow beam, wide angle, and elliptical beam types. The heat resisting glass front is set in a weatherproof ring.
150w—2000w lamps.



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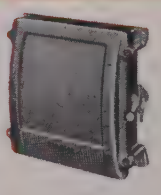


The Simplex ACF (anti-corrosion fluorescent) fitting is protected by a specially patented process that will not rust even in the heaviest corrosive atmospheres.
20w—125w tubes.

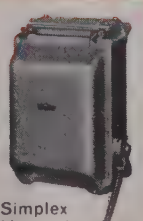


The Simplex Star switchfuse designed for front operation and for either HRC or rewireable fuses. The Star range of 500 volt switchfuses, distribution fuseboards, busbar chambers and switchboard assemblies is complementary to the Regent and Monarch ranges of Simplex switchgear.

In the electrical field, Simplex have been out in the lead for 60 years. Significant? Not very. We are looking ahead, not back. We are very happy to be so far in advance now, at this point in time. We intend to stay there next year, in ten years, as long as the best brains in the industry can keep us there. This isn't just a paean of self-praise. It's a cogent reason for keeping in touch with Simplex developments, for specifying Simplex equipment, for thinking of Simplex first, every time.



Simplex Regent range. Robust but stylishly designed 500 volt switchgear of conventional construction.



Simplex Monarch 500 volt 150 and 300 amp switches and fuse switch of robust all-cast construction suitable for heaviest duty.

Simplex

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airblast switchgear
incorporating casting by
William Mills Ltd.



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Good ductility

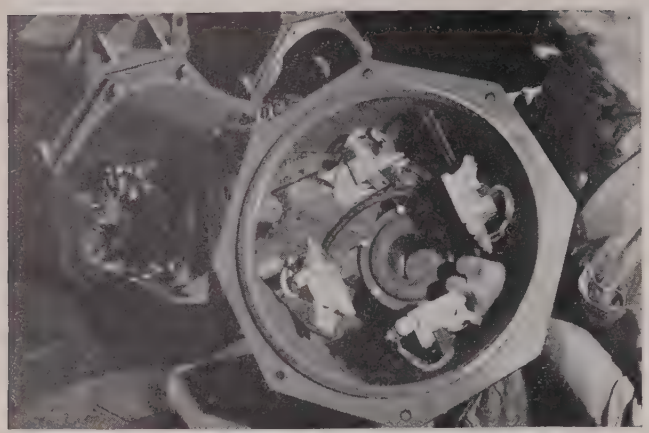
Good corrosion resistance

Good shock resistance

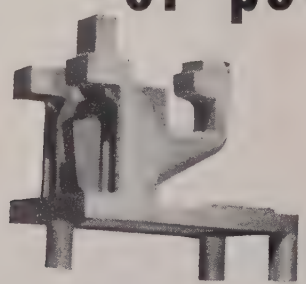
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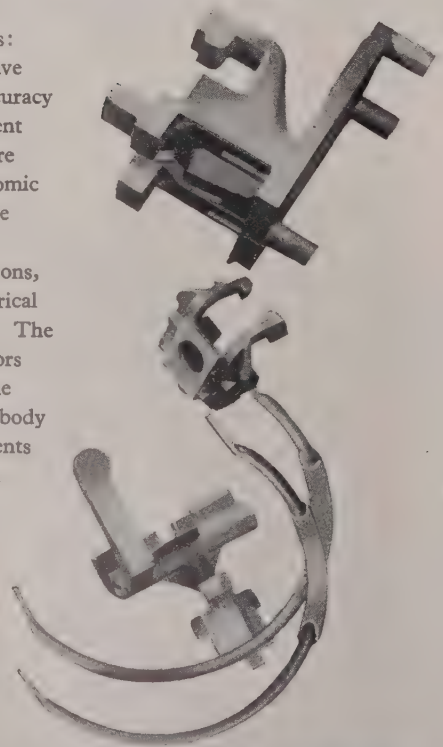
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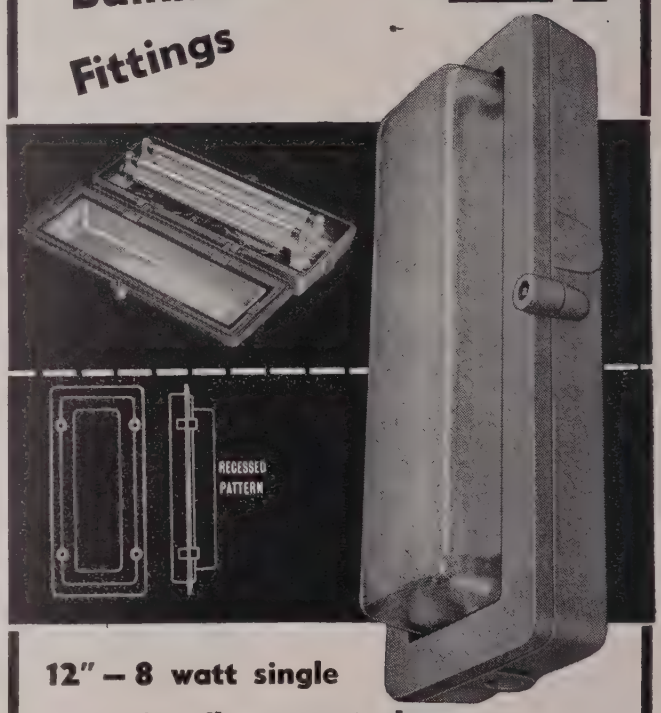
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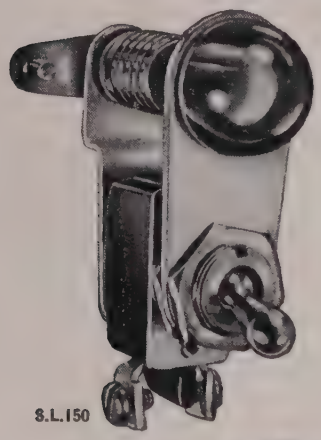
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S.L.162

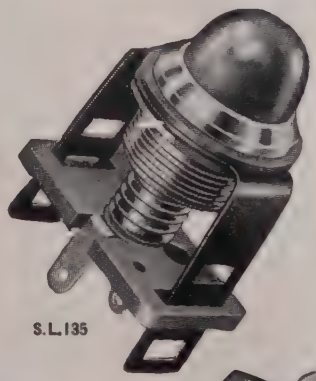

S.L.160

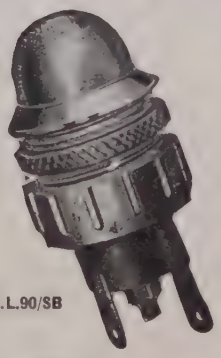

S.L.150

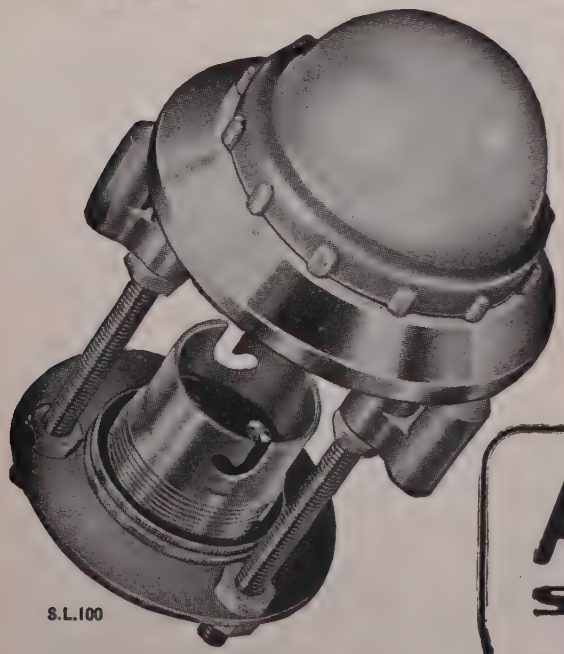

S.L.50

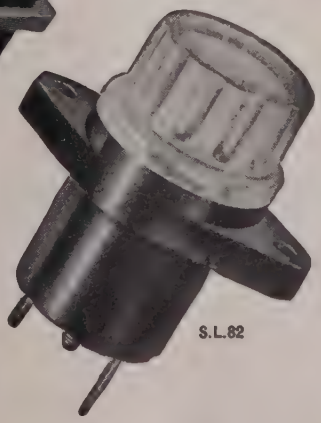

S.L.130


S.L.86


S.L.135


S.L.90/SB


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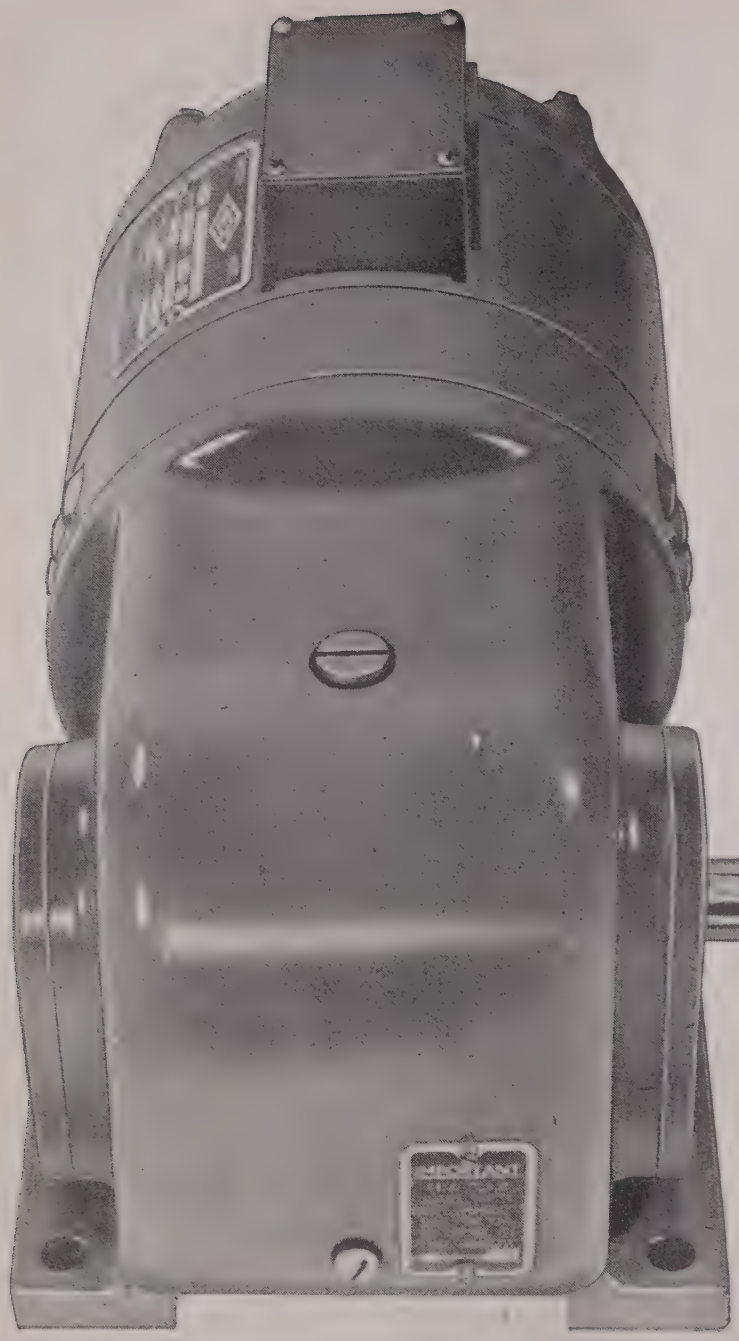
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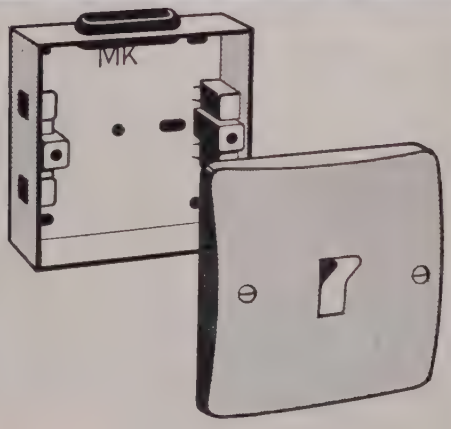
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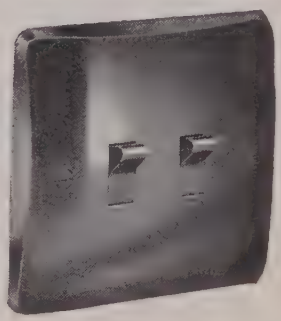
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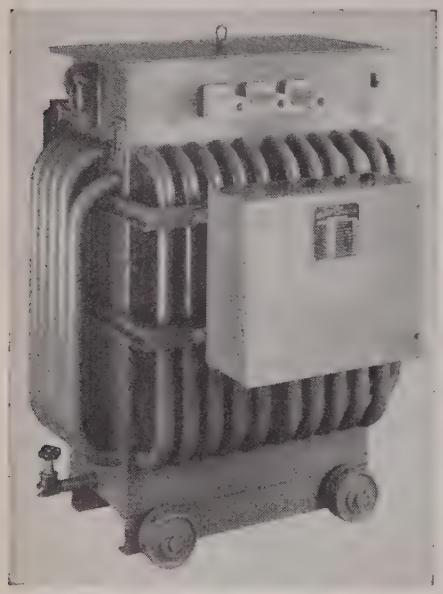
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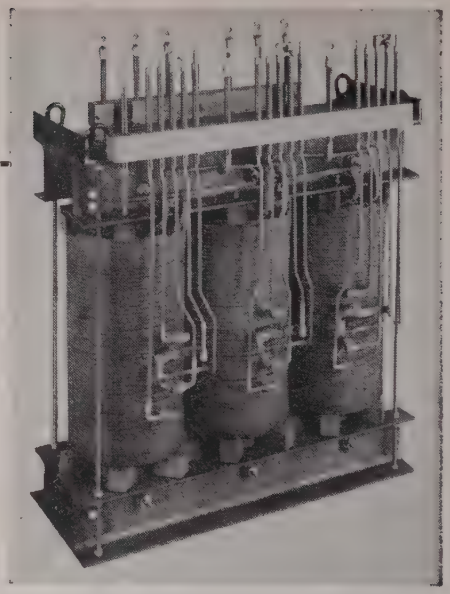
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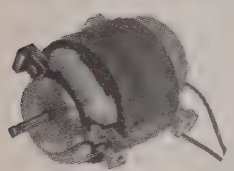
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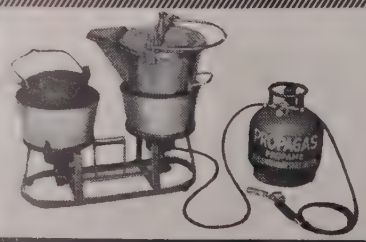
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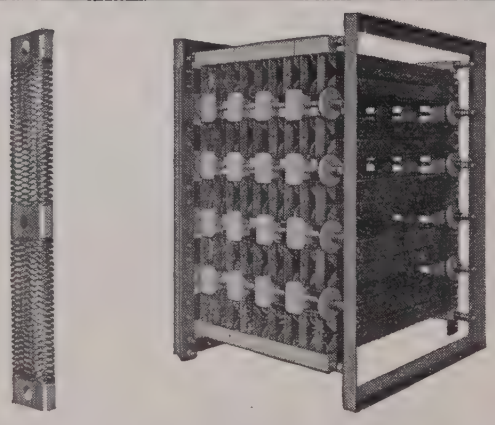
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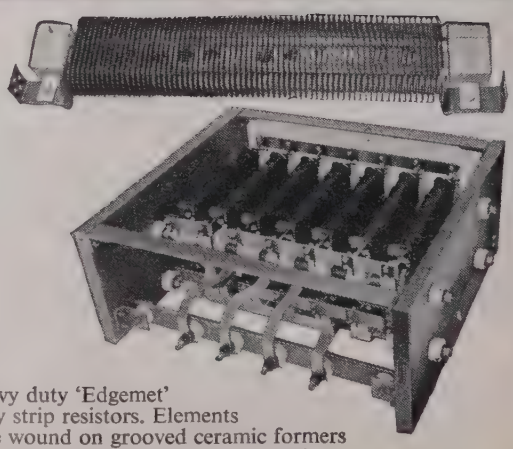
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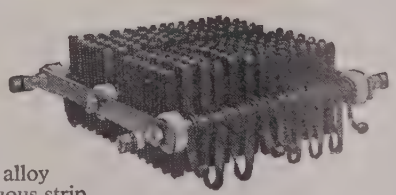
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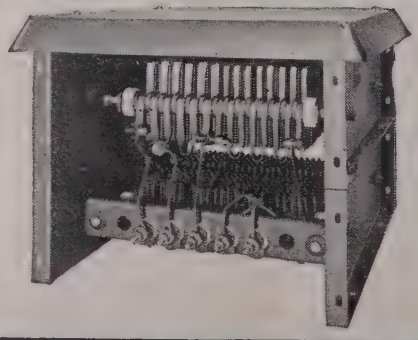


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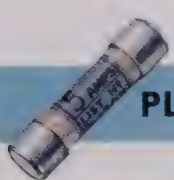
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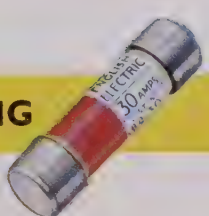


PLUGS



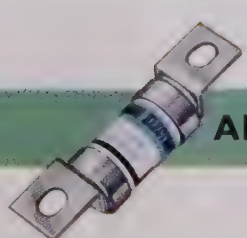
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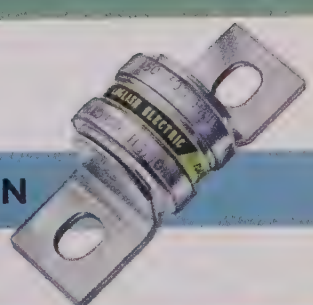


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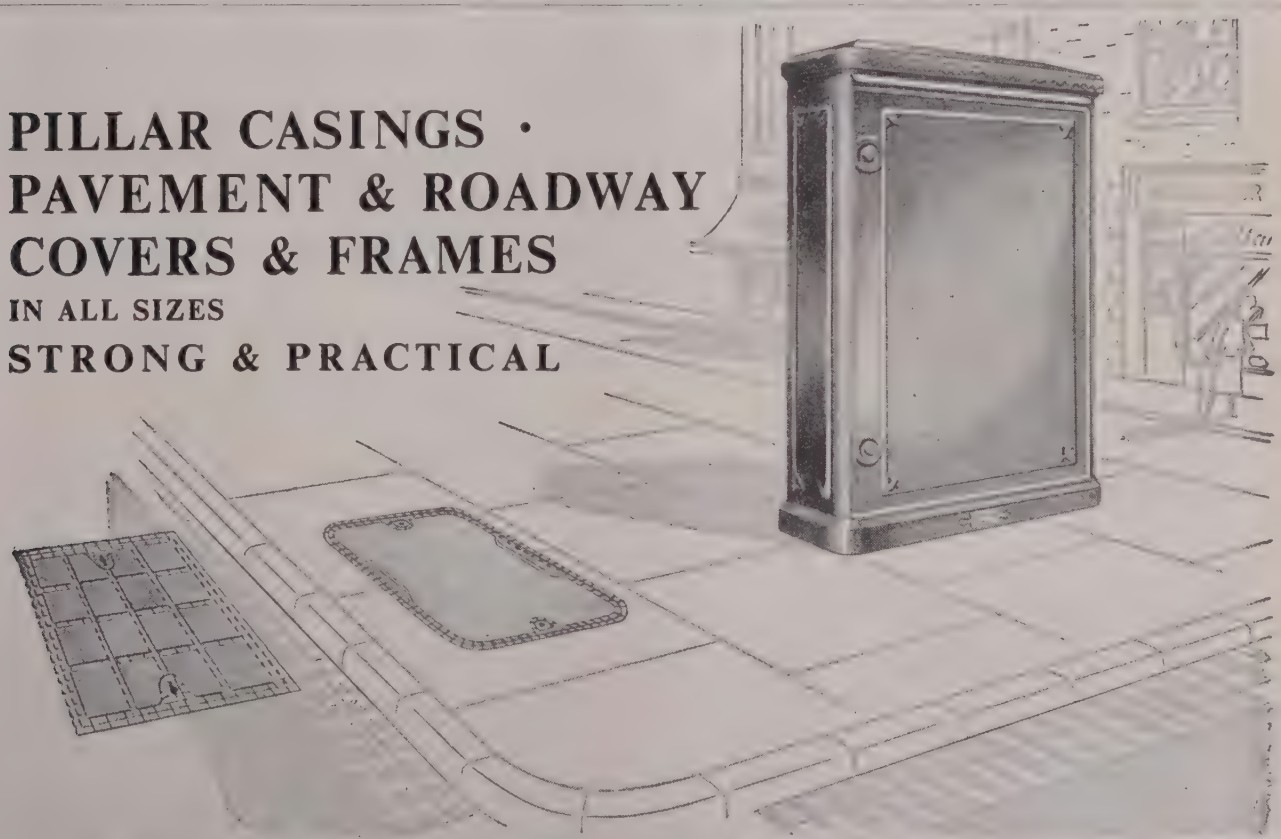
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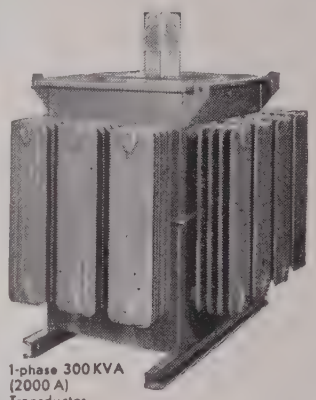
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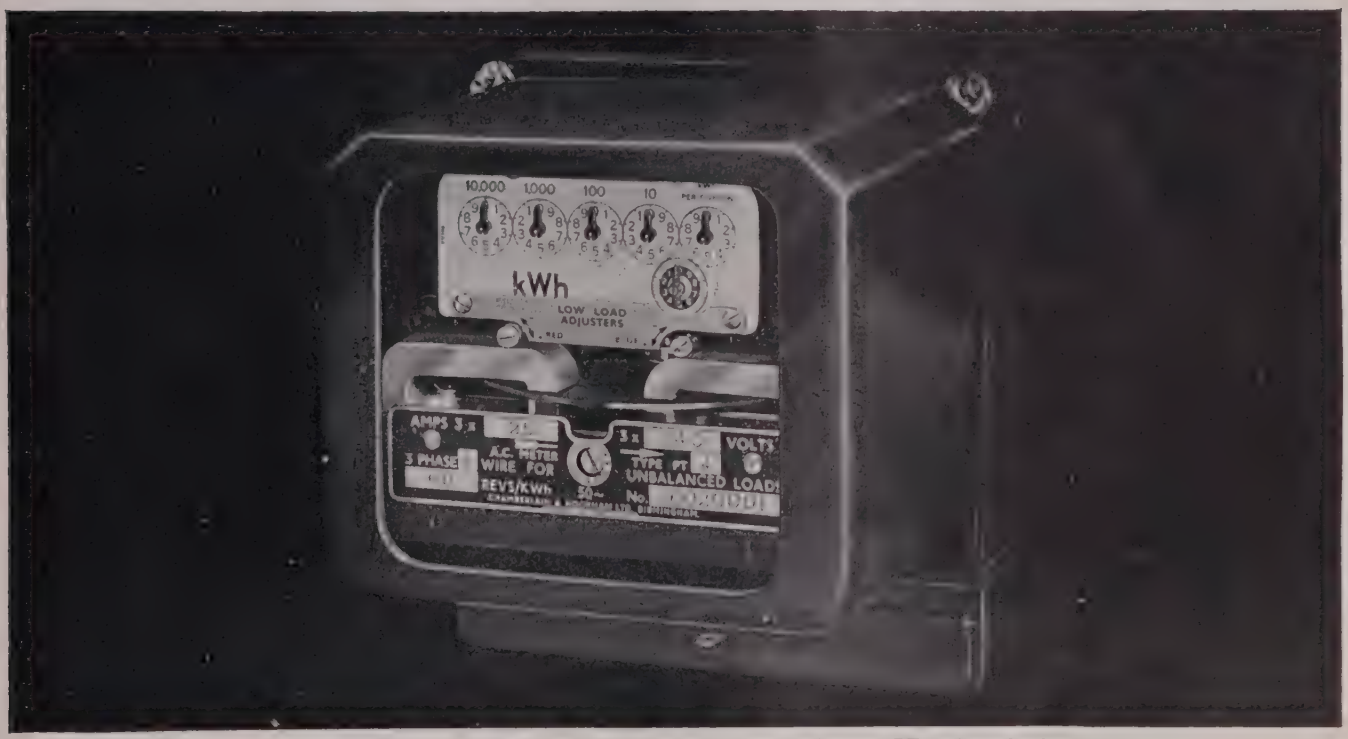


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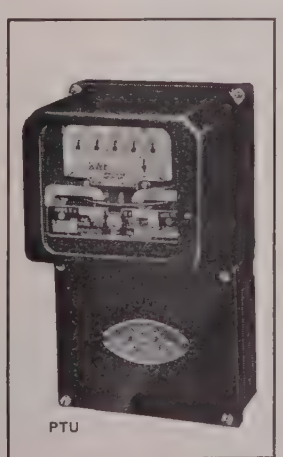
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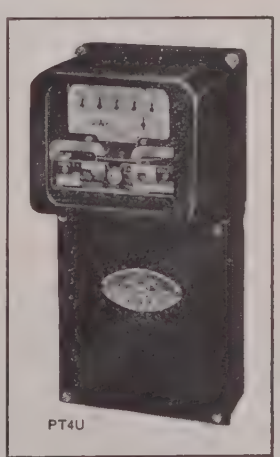
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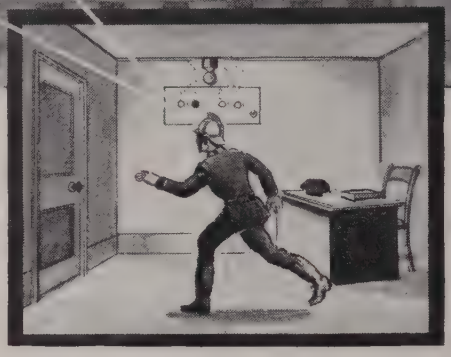


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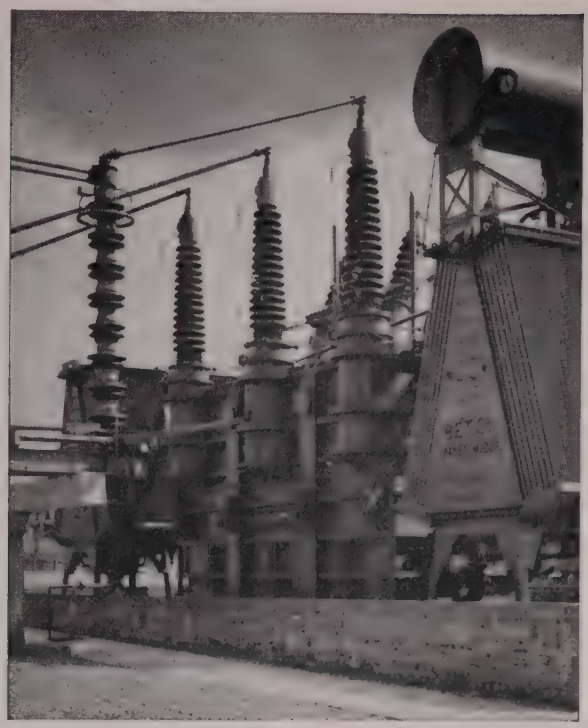
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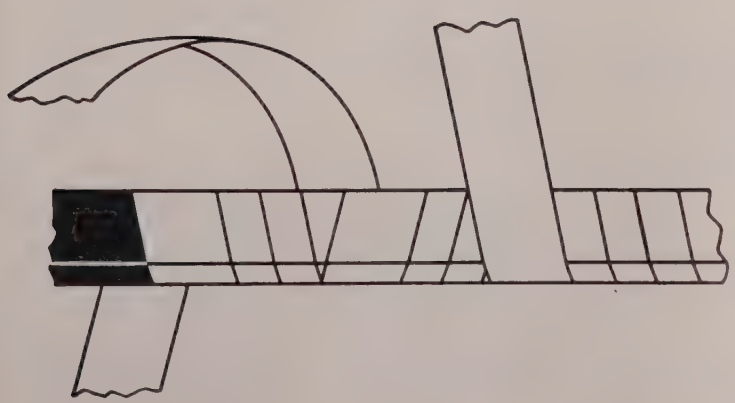
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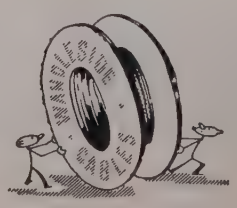
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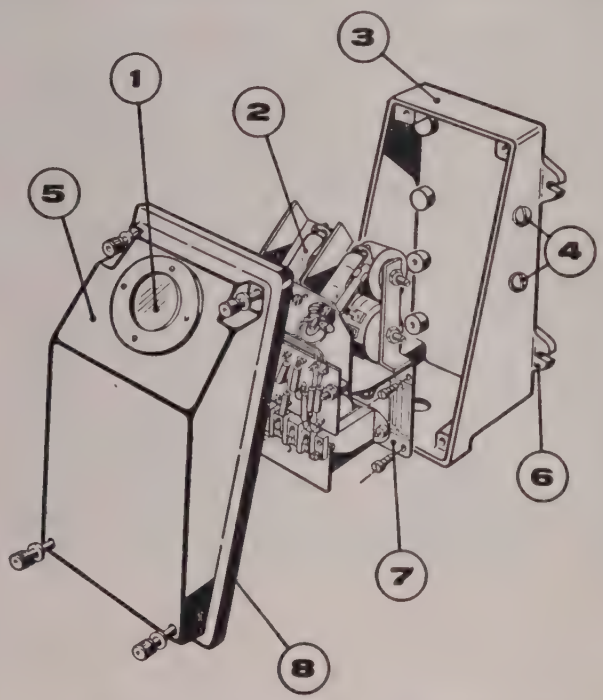


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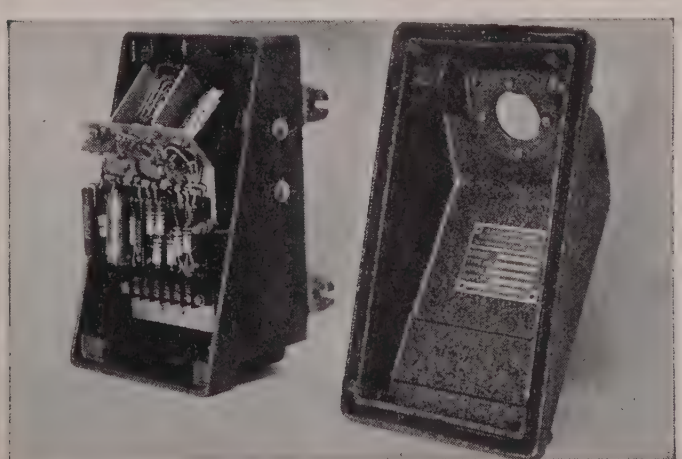


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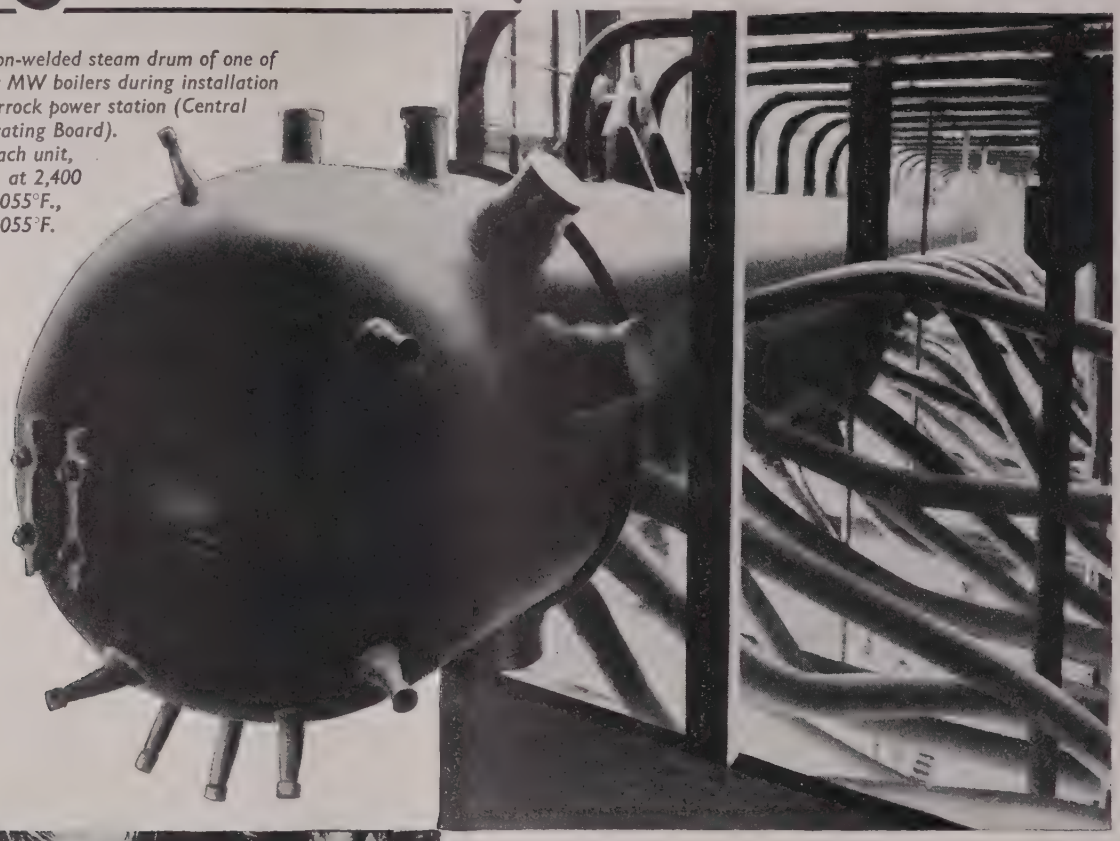
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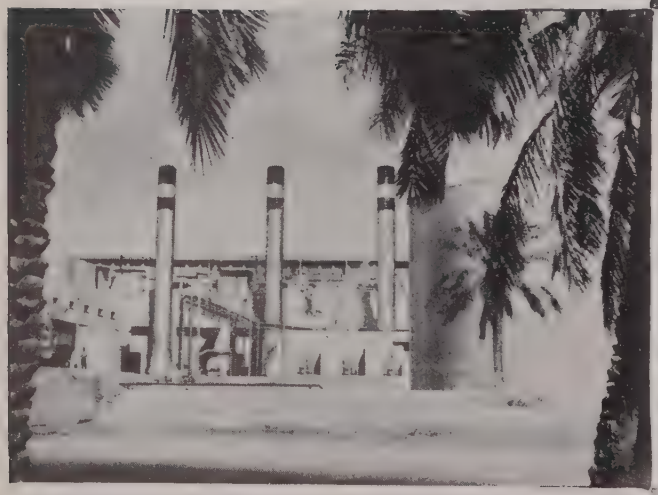
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(Above) Power station at Basrah, Republic of Iraq, equipped with three 165,000 lb./hr. BABCOCK Type FH Integral-Furnace, oil and natural-gas fired boilers. (Consulting Engineers : Ewbank & Partners).

(Right) VENEZUELA. Babcock boilers at the Tacoa power station of La Electricidad de Caracas, including units of 550,000 lb./hr. capacity, fired by oil and natural gas. (Consulting Engineers : Sofina).



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ELECTRICAL REVIEW

Friday 8 September 1961 Volume 169 No 10

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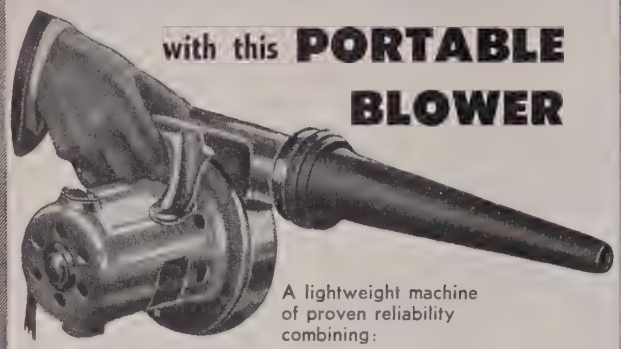
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ELECTRICAL REVIEW

8 September 1961 Vol. 169 No. 10 Established 1872

Selling Illumination

THE gap between the best modern standards and what is normally practised would appear to be wider in lighting than in almost any other branch of electrical engineering. Many miles of London's streets are still lit by gas (three principal bridges are being converted this month) and many roads throughout the country are lit to no better levels by electricity; in offices (as earlier in factories) legislation has become necessary to ensure adequate conditions of lighting; and a new house provided with more than a single central ceiling rose in each room is a rare exception. This is a deplorable situation in 1961.

The reason why application has lagged so far behind the fruits of research is not obvious. The continuous efforts of the electric lamp industry have not only achieved a remarkable technical advance in light sources but improvements in efficiency have steadily reduced the cost of lighting. Lamps have never been better and light has never been cheaper than today. Yet high cost is the explanation most frequently given for failure to provide a more generous amount of light or to replace an old installation. Lighting is also among the first items to be cut when the costs of a building have to be reduced. This despite the fact that a good lighting installation accounts for only a very small proportion of the capital cost and annual running charges of a building and an even smaller part of the salaries of those who work in it.

Such a parsimonious attitude towards the provision of adequate artificial light would be less prevalent if the advantages to be gained from a well-planned installation were more widely appreciated by architects and their clients. One barrier to progress has surely been the fact that our basic requirements of seeing can be so easily satisfied. A dramatic change from darkness to light can be obtained at the flick of a switch; the benefits from providing higher levels of illumination than this minimum, or from a proper integration of daylight and artificial light, are more subtle and require careful presentation and explanation. Strong economic and social arguments can be advanced in support of better standards, but example is likely to prove the most effective weapon in promoting a more rapid change. Those who have experienced a good modern installation will not willingly suffer

anything inferior. Manufacturers and Area Boards, who cannot escape some blame for the present situation, could help to promote better conditions by devoting more effort and publicity to selling illumination with rather less emphasis on individual fittings and light sources.

Much excellent work is of course being done by the British Lighting Council, and in this the co-operative efforts of the manufacturers—started in the Lighting Service Bureau—are now supported by the electricity supply industry. Nevertheless the B.L.C.'s budget is clearly small compared with the resources of the industry and its expenditure on advertising. This being so, the Council have rightly been selective in their approach and have concentrated their energies primarily on architects and others in a position to influence the specification of lighting. Faster progress will come only by creating a public demand for higher standards. On the basis of their showing in the past, one would like to see the B.L.C. given the financial backing to embark on a national campaign for better lighting.

The current trends underlying the movement towards improvements in the application of artificial light are the subject of five articles in this issue under the general heading " New Prospects in Lighting." The new I.E.S. Code is their starting point, but it is significant that greater emphasis is placed on the fundamental change in lighting practice that this may engender rather than on the immediate advance in light levels. One important aspect of this, illustrated in the *Canberra* article and elsewhere, is the full integration of architecture and lighting.

THEATRICAL PRODUCTIONS

Good stage lighting depends on the co-operation of the illuminating engineer, the electrical engineer and the artist in producing light which can be controlled—in direction, quantity and colour. In many productions, the scene changes very frequently so that the control console and the associated dimming equipment have to be both flexible and compact. Despite the introduction of saturable reactor and silicon controlled rectifier dimmers, the electro-mechanical system still has the advantage of being more controllable, particularly when associated with the " organ " console.

This type of console was invented and developed in this country and it provides a switchboard which is probably more compact and versatile than any other system. In consequence about half the output of British stage lighting equipment is exported. Added impetus would, no doubt, be provided if British lamp manufacturers were persuaded to overcome their apparent reluctance to produce special forms of projector lamps suitable for the theatre.

WINTER FARE

After the summer lull, the customary round of electrical evening functions is close upon us. Some of the associations have already started up, but the main programme of the Institution of Electrical Engineers begins in October with the delivery by Mr. G. S. C. Lucas of his presidential address. The highlight of the forthcoming season is the Jubilee Dinner of the British Electrical & Allied Manufacturers' Association at Grosvenor House on 31st October. The Prime Minister has promised to attend the dinner as the principal guest and he will propose the toast of " The British Electrical & Allied Industries " to which Lord Chandos, chairman of Associated Electrical Industries, Ltd., will respond. Mr. A. M. Browne, president of the Association, will be in the chair, and an attendance of something like 1,200 is expected. Two other important B.E.A.M.A. events which are on the way are the Export Conference and the annual Publicity Conference.

MOTOR SPECIFICATIONS

The virtues of establishing a standard specification for any equipment or component cannot be denied. Such standards are usually produced as a result of discussions between users and manufacturers and basically form a compromise between what is desired and what is possible. A difficulty arises in avoiding premature obsolescence, for technological development does not cease once a standard comes into force. Consequently standards have to be revised periodically and since this is done on a national basis there is a tendency for a certain amount of " leap-frogging."

In the case of electric motors, the first practical established dimensional standards were those of the National Electrical Manufacturers' Association of America (N.E.M.A.). In 1954, the first United Kingdom range of standard dimensions was produced, identical to the N.E.M.A. dimensions but with higher outputs by virtue of using more modern techniques. These were laid down in B.S. 2083. In 1958, B.S. 2960 was issued covering ventilated motors from 1 to 50 h.p. with revised N.E.M.A. dimensions, but with the corresponding output obtained from one frame size smaller. These are compatible with the recommendations published by the I.E.C. in 1960. Earlier this year part 2 of B.S. 2960 was produced, covering totally-enclosed fan-cooled motors with outputs equal to those of ventilated units of corresponding size. At about the same time Deutsche Industrie Normen (D.I.N.) specified t.e.f.c. motors conforming to the I.E.C. dimensions but with higher outputs than those laid down by the B.S.I., and proposals for ventilated motors with even higher outputs for a given frame size are apparently being considered.

The importance of meeting all current specifications is emphasised by the possibility of Britain joining the Common Market. It is gratifying, therefore, to record (1st September issue, p. 347) the introduction by a British manufacturer of motors which conform to the latest German specification and yet, with minor and therefore not costly variations in assembly, can comply with British Standards.

Lighting the *Canberra*

By G. CARTER and
A. E. FOTHERGILL, Dip.M.I.E.S.



Spiral staircase leading to the 1st class observation lounge

THE interiors of the P. & O. liner *Canberra* are as big a break with tradition as her hull. It will be recalled (*Electrical Review*, 2nd June) that the *Canberra* has her propulsion machinery and smoke stack at the stern, which allows much greater freedom for the arrangement of the passenger accommodation. The effective use that has been made of this freedom by architects is plain from the illustrations. They also show what can be achieved by close and continuous co-operation between architects and lighting engineers, both in ambitious and decorative schemes and in the lighting of passenger cabins and gangways.

A number of architects were commissioned to design schemes for the many public rooms involved. All of them were quick to appreciate that the lighting formed an extremely important part of their decorative schemes, that it could do much to enhance (or even change) the atmosphere or character of the spaces.

More than three years before the trials, discussions began between the architects and lighting consultants.

Various combinations of tungsten and cold-cathode lighting can be used in the 1st class dining saloon. Here the full lighting produces a cheerful atmosphere for breakfast. The "windows" in the background are formed by cold-cathode tubes behind "Perspex" diffusers softened by a mesh of closely woven reeds





▲ *To meet the architect's demand for a continuous lighting feature around the periphery of this 1st class lounge, cold-cathode tubes are arranged above a suspended polystyrene louvre. They are positioned to give a fall-off of light towards the bulkheads which are hung with white net curtains*

In the "Bonito Club" twenty-two lines of tubes are concealed behind an unusual diffuser of fibreglass sheets which sandwich a honeycomb metal foil. The intensity of the light can be varied by motor-operated dimmers. Experiments showed that the diffuser has a mellowing effect on the light from the warm-white tubes and the resultant colour gives a radiant warmth to this space. The vertical features which run the full height of the deck have two lines of tubes behind diffusers ▼

A complete set of cabins were erected at the factory of Heaton Tabb & Co., Ltd., and with the various arrangements of furniture and other equipment, a number of lighting proposals were agreed upon. Not only does the restricted height of cabins prohibit the use of suspended lighting fittings, except in a few special instances such as above dressing tables, but there is very little room to recess into the ceiling, particularly in the way of the ship's frames, and there are pipe runs, trunking and other services to be avoided. These are constant problems facing the lighting engineer aboard ship.

Another difficulty is the need for modifications as further information concerning the structure of the ship becomes available, positions of trunking and pipes, etc., are established and, of course, the architects may also have new ideas.

In the forming of the decorative schemes, virtually continuous communication and consultation between all parties, including the shipbuilders and decorative contractors, was necessary. The G.E.C. Research Laboratories were used to demonstrate various lighting effects and, indeed, prototypes of many of the indirect lighting coves and louvres were erected and approved at Wembley.

Problems associated with lighting installations on land also apply to ships' installations but there are additional factors which must be taken into account as these influence the choice of light sources and their mode of use. Integration with other services, low deckheads and restricted space between them, conformity with marine regulations, vibration and corrosion, are all problems which beset the lighting engineer and designer.

In the *Canberra* the lighting engineer also had to contend with a 230 V, 60 c/s line-to-line delta-connected unearthed a.c. system. This led to the development of special gear for all hot cathode lamps because with this unusual supply arrangement there is no potential between the lamp cathode and the earth stripe on the tube as is usual with a conventional shore 415/230 V, three-phase, four-wire, star-connected system with earthed neutral. As is known, this potential is instrumental in achieving reliable starting, particularly when temperature and humidity conditions are adverse.

The architects' ideas on how the lighting would contribute to the appearance and atmosphere of the rooms form the basis of all the lighting schemes. In the main, cold









▲ *The suspended ceiling feature in the "Peacock Room" was modified by the designer, John Adam, to conceal cold-cathode tubes between the slats. The interplay of light and shadow on the slats is achieved by a few carefully positioned recessed tungsten fittings. The warm mellow interiors of the cardrooms behind are a pleasant contrast*



▶ *A typical four-berth tourist cabin showing the tungsten berthlights and the toilet cabinet fitted with an 18in 15 W hot-cathode lamp. Further fittings are provided over wash basins and in the deckhead*

◀ *As can be seen from the detail on the opposite page the berthlight is of extremely simple design. It comprises a metal cylinder containing a 25 W tubular lamp and the apertures are carefully designed to provide light in the correct area. The berthlights in the 1st class cabins are fully adjustable and a change of position converts the left-hand lamp from a reading lamp to a berthlight*



The main lighting in the "Island Room," which is the tourist dance space, is provided by random clusters of 200 tungsten fittings using "Perspex" diffusers of special design. In addition, concealed cold-cathode tubes light the outboard areas and these can be varied by dimmer controls

"W.G." looks on approvingly at this display of cricket gear in the "Cricketers' Tavern." The recessed tungsten spotlights almost escape notice in the unusual ceiling treatment. Additional tungsten lamps concealed behind the seats throw light on the ceiling and walls





Exposed multi-coloured cold-cathode tubing fits the mood of the teenage "Pop Inn." The tungsten lighting in the dancing area can be replaced by ultra-violet light for short intervals to show whose shirt is "whiter than white"



In the tourist restaurant concealed cold-cathode lighting along the walls supplements the main tungsten lighting from dual-purpose fittings above each table

cathode tubing has been used for concealed lighting in cornices of set shape and length; it has also been used for large luminous features incorporating diffusers or louvres, simply because this form of lighting is so adaptable and has a long and trouble-free life. Tungsten lighting, with one or two exceptions, is employed where additional lighting is needed over relatively small areas and where the architects' interior design called for unobtrusive lighting fittings.

Two basic fully-recessed types were developed for use throughout the public rooms. Both are free of all visible fixings; in tourist areas a plain metal spinning has the lamp fixed well up inside to prevent it being seen from normal angles. A system of grey painted louvre rings is used in the fitting in first-class areas giving a rigid cut-off to the lamps and a low surface brightness. Hot cathode fittings are used for all accommodation areas.

Among the many innovations is the illuminated spiral staircase from the " Meridian Room " to the " Crow's Nest " (first-class observation lounge)—the first of its kind aboard ship. Cold cathode tubing, the only light source which could be made to follow faithfully the irregular shape in three dimensions, is concealed behind a " Perspex " diffuser running along the underside of the inner and outer balustrades and dramatically lights the stair treads.

A decorative feature immediately above this staircase consists of a large cone of neutral " Perspex " having in its base a complex arrangement of thicknesses and prisms of clear " Perspex " to refract and scatter the light from 16 low-voltage spotlights housed within the ceiling.

Flexibility in lighting to promote a feeling of well-being in harmony with the mood and time of day, was the architects' requirement for the two restaurants which have no natural light. This is achieved in quite different ways. Two lighting systems have been incorporated in a dual-purpose tungsten fitting which is recessed into the ceiling of the tourist restaurant. One reflector system provides a widely distributed bright light for breakfast and lunch, but in the evening a restricted beam of light is directed towards the tables, giving a more intimate atmosphere. In addition, the white and gold cathode tubing concealed in coves along the walls and in the central area, can be separately switched so that for dinner these areas are bathed in rich gold light.

The impression of sunlit windows along the walls of the first-class restaurant is achieved by rows of warm-white cold cathode tubing behind " Perspex " panels with a texture of woven reeds on the inside. This is supplemented outboard by further tubes behind diffusing slots in the deckhead, and in the central area by a random array of fibreglass cylinders of different diameters and lengths. For breakfast and lunch all lighting is on. At night the main tungsten and cold cathode lighting is switched off and individual table lamps are plugged into the socket provided in each table. The " windows " no longer admit " sunlight "; the lighting is restricted to a single line of tubing concealed in the sill.

Polystyrene louvres with cold cathode tubing above, which are used extensively in the first-class spaces, provide a continuous feature around the periphery of the "Meridian Room." Experiments were carried out to determine the tube arrangement for achieving a gradual falling-off in intensity from one side of the louvre to the other. Although there is over 18in between the underside of the louvre and the deckhead, in certain areas trunking, sprinklers, pipes and valves, etc., finally restricted headroom to about 8in.

The *Canberra* also provided opportunities for unconventional lighting treatment in the areas for younger passengers. In the " Pop Inn " for " teenagers " the architect's desire for the lighting to be gay and stimulating was met by an unusual free form of multi-coloured cold cathode tubes fitted below the ceiling. In both the tourist and first-class children's rooms, a little of the fairground is present. Running lights fitted in the ceiling above the cycles and chairs follow the young cyclists as they propel the carousels. For general lighting there are small tungsten fittings set out as the night sky.

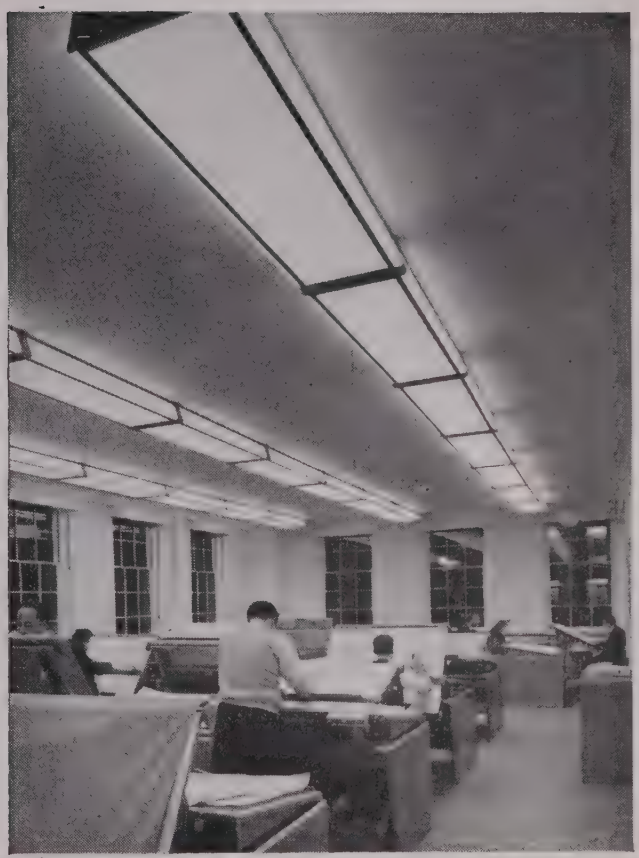
The special features of the " Bonito Club " and " Island Room " are described in the captions.

In all, some 20,000 fittings and three miles of cold cathode tubing make this one of the largest lighting installations afloat.

Office Lighting



— towards higher standards



An overall illumination of 75 lm/sq ft is provided in this drawing office at the Power Gas Corporation's offices, Portland Place, London, by specially designed twin-lamp fluorescent fittings fitted with Paragrid-tile diffusers and "Perspex" sides mounted in continuous runs. The control gear is mounted between the lamps and each draughtsman can control the fitting immediately above him by means of a pull switch. (Harris & Sheldon Electrical, Ltd.)

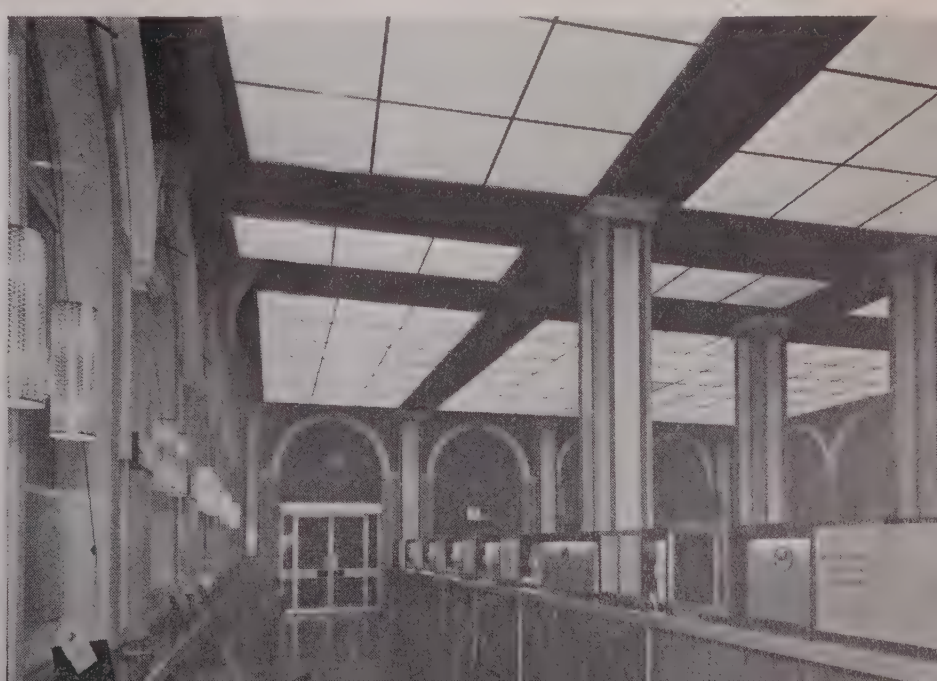
FOR over three million people in this country an office provides the environment of their working lives, and the number is increasing steadily. Yet until recently relatively little attention has been given to the effect of office conditions on those who work in them and on the quality of their output.

In legislation also offices have lagged behind factories. This is now to change. An Act on the Statute Book, which becomes effective on 1st January, 1962, makes the "provision of sufficient and suitable lighting" in offices enforceable by law. The Government have, however, promised to replace and widen the scope of this Act during the coming session by an Enabling Bill that will cover, in addition to lighting, conditions of heating, ventilation and sanitation in offices, shops and railway premises.

Good lighting can make a major contribution by promoting efficiency, reducing fatigue and by creating a bright and attractive atmosphere. It is not known what levels of illumination will be fixed under the new provisions (or when they will come into force), but it is to be hoped that despite the leeway to be made up they will accord with modern standards.

The new I.E.S. Code recommends an illumination level of 30 lm/sq ft in general offices. This compares with the previous recommendation (1955 edition) of 20 lm/sq ft and a level of only 8 lm/sq ft which was the "most frequently observed value" in a survey carried out by the Central Office of Information in 1948. Though the latest recommendation is a considerable advance, it still takes into account what is thought economically practicable in present circumstances. A level of 50 to 100 lm/sq ft may be expected in progressive offices in the near future and 100 to 150 lm/sq ft is already recommended by the Illuminating Engineering Society of America. The trend is clearly upward and whatever the levels fixed by the Government the wise employer will allow for a further

In the news room of the Daily Mirror building daylight from the side windows and roof lights is supplemented by a high level of artificial illumination. The fittings, supplied by Philips Electrical, Ltd., each house two 5ft 80 W warm-white tubes and at night they provide an average desk top illumination of 35 lm/sq ft



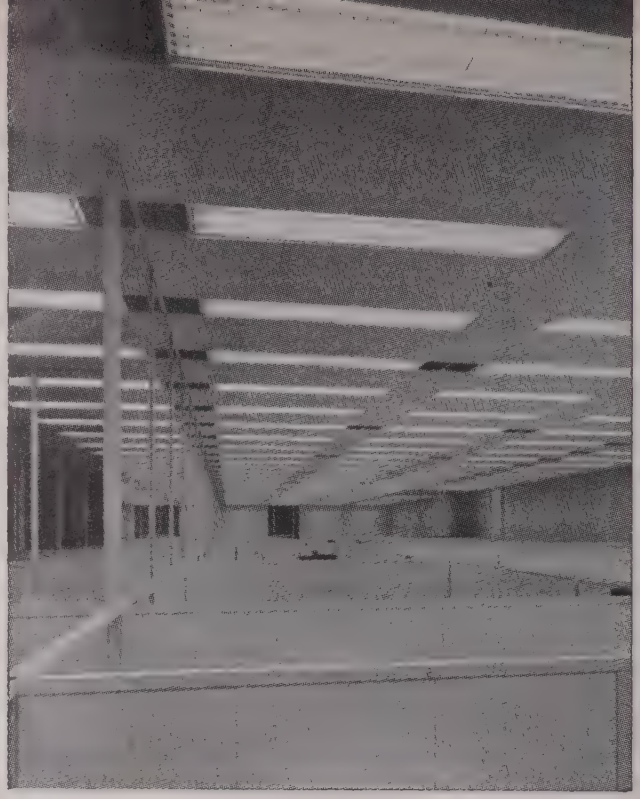
The 1,737 sq ft module installation in Lloyds Bank, St. Helier, Jersey, C.I. The 3ft square plastic panels are supported in an aluminium track and diffuse the light from 5ft 80 W and 8ft 125 W warm-white tubes situated in the plenum. (Lumenated Ceilings, Ltd.)

advance when an office is rewired for a new installation.

It may be noted here that when the British Lighting Council gave people the opportunity, in a specially designed room, of selecting any value of illumination up to 450 lm/sq ft in relation to typical office tasks the *average* choice was about 200 lm/sq ft.

The move towards higher standards in offices has important implications for the electrical industry. Apart from the increased business for manufacturers and contractors, the supply side will benefit from the longer hours of use that higher illumination levels and the extension of permanent supplementary artificial lighting of interiors (as explained on page 376) will involve. At the same time the importance of glare control and a greater attention to colour will put a premium on careful design and closer co-operation between those concerned in the construction and equipping of offices.

The levels set by the Government and the extent to which the electrical industry exploits this opportunity will affect the rate of progress. But example may provide the greatest stimulus. The accompanying illustrations show what is already being done. Less advanced employers are likely to experience increasing difficulty in obtaining and retaining staff expected to work in ill-lighted offices.



Recessed modular units with louvred diffusers in the United States Embassy. The units vary in length from 4ft to 10ft. The special module used in the building necessitated different flange-widths on the length of the fittings to support the false ceiling. (Atlas Lighting, Ltd.)



The excellent corridor lighting is a feature of GKN House, the London headquarters of Guest, Keen and Nettlefolds, Ltd., and its subsidiary companies. The fittings were specially designed by the General Electric Co., Ltd., and their position on the wall facilitates cleaning



In the exhibition area on the ground floor of English Electric House the Crompton Parkinson "Modulume" ceiling has been specially designed in a lozenge shape to match the pattern of the floor covering





▲ *Colour in combination with good lighting is an important factor in improving working conditions in offices as is shown by this office at GKN House*

◀ *An illumination level of 500 lm/sq ft (shown here) can be provided in this experimental area at Thorn House. Normally only the first of the three 170 lm/sq ft stages is used. The installation employs 135 8ft 125 W tubes above a ½in mesh plastic louvre diffuser. The metal baffles reduce the apparent ceiling area by about a third when viewed at room centre*

▼ *A reception area and open office, also at GKN House. The lighting fittings were specially designed by A.E.I.*





A

A. *"Ondine" at Aldwych Theatre, London, showing the stage lighting strictly localised to the two different settings*

B. *The same as "A" but under working and house lights. The stage can be seen projecting well out into the auditorium clear of the proscenium arch*

C. *View of the lighting over the stage, some of which provides the effect in "A"*

D. *Lighting console of the type used to control the stage lighting in the Aldwych and similar theatres*



B



C



D

Stage Lighting 1961

By FREDERICK BENTHAM, F.I.E.S.*

The purpose of stage lighting is to create an illusion, more often by concealing than by revealing shapes and objects. One of the most important requirements of an installation is a lighting control console which is compact and flexible. This largely depends upon the method of lamp dimming used

IT is very difficult to judge a stage lighting installation as such since it is so much part of a theatrical production. What one ultimately sees on the stage is the result of the producer's attempt to co-ordinate all his forces to the service of the conception that his imagination has given him of a particular play. Stage lighting is, thus, quite unlike any other form of lighting because mere illumination plays such a little part. Apart from the necessary flexibility of the installation, the lighting has to provide an illusion—it has often to conceal far more than it reveals. Whether the lighting equipment is good or bad, well arranged or not, will not of itself be apparent.

Stage lighting can be understood in terms of painting a picture with light: not only a picture but many pictures following one after the other. The process of painting a picture does not involve slopping large washes of colour over the canvas; it involves putting the paint exactly where it is required, sometimes isolating particular colours, at others causing colours to merge one with another (plate A on facing page). It is the same with stage lighting and this explains why fluorescent lighting is virtually of no use for the stage since, being uncontrollable, the light floods all over the place.

The only exception to the rule of localising light may be the sky effect at the back of the stage, known as the cyclorama. This requires a blue wash of light and, in fact, in the German opera houses, a bank of fluorescent lights for this purpose is used, but outside opera very few theatres are of the scale or their scenery of the type that needs an evenly flooded cyclorama background. At the moment, naturalism in the theatre is at a discount and so sky effects are little required and indeed the new forms of staging, which often bring the actors right out into the auditorium (plate B) and perhaps surround them by audience, tend to emphasise further the need for lighting units which will localise the light.

Projector Lamps

The source of light round which modern stage lighting is built is the projector lamp—a tungsten filament lamp forming a compact source which can be dimmed by dropping the line voltage. In Britain, we have been considerably handicapped by the reluctance of lamp manufacturers to make special forms of these suitable for the theatre; the lamp industries of the United States and of Germany are far more progressive and helpful. It is a matter of wonder that, dependent as we are on so few suitable sources, British stage lighting is so progressive (40 per cent of the output is exported, some of it even to Germany).

The lamps used in this country are the 250 and 500 W Class T (interchangeable for light centre) with a medium pre-focus cap, and the 1,000 W Class T and the 2,000 W Class S lamps. The 2,000 W is but little used at present largely on account of the bulb size and the fact that it has only recently become interchangeable with 1,000 W lamps for light centre by a change from a large pre-focus to a bi-post holder on the same fixings. These two have, in fact, quite different caps.

The Class T range itself is a comparative newcomer to the theatre, being some ten years old. It is commonly said that the market for lamps in the theatre is not large enough, but as these lamps have a life of only 200 hours and also the lanterns to contain them are made in batches of 5,000 at a time this is quite a feeble excuse. The lamps are hand-made anyway.

Lanterns

There are two main classes of lantern—known as soft-edge spotlights and profile spotlights, respectively. Fig. 1 shows a section through a soft-edge spotlight. The lamp is moved relative to the short focus fresnel lens plate and

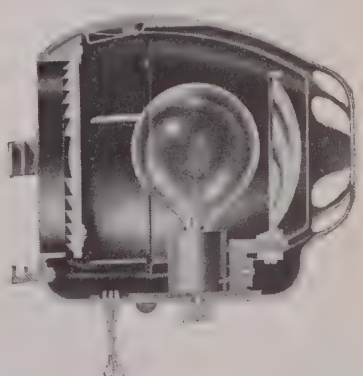


Fig. 1.—Cross-section of a soft-edge beam (fresnel) spotlight, 250/500 W size

a range of image sizes is produced. The beam divergence is variable between about 12 and 55°. The beam is soft edged but nevertheless the area of light is well defined and is, of course, always circular because of the shape of the lamp filament. At the back of the lamp a small accessory reflector prevents waste of light in that direction.

With the profile spot, the reflector is the main light

* Director, Strand Electric & Engineering Co., Ltd.

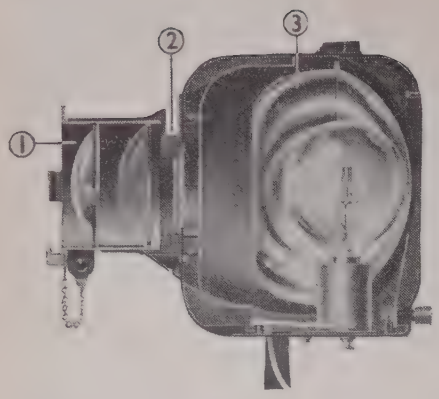


Fig. 2.—Cross-section of a profile spotlight, 250/500 W size

1. Lens. 2. Gate. 3. Reflector

collector and Fig. 2 shows how large its area becomes. This reflector is generally but not necessarily ellipsoidal in shape and the light is crossed at the gate position; the gate itself is focused by the lens. This means that the beam can be shaped to any profile by inserting a mask or diaphragm in the gate and indeed sometimes crude cloud shapes, patterns of prison cell bars, etc., are projected by using suitable slides.

Using the two types of lantern in reasonably large numbers, a pattern of light can be built up either of more or less localised flooding with soft edges or of defined areas. Further light control is often necessary and barn-door flaps are sometimes fitted to the soft-edge spots to prevent spill of ghost light beyond the main beam. Generally speaking, the profile spotlight is used out in the auditorium where a large part of the lighting directed at the stage is found nowadays and the fresnel is the main lantern for use on-stage.

Lighting Layout

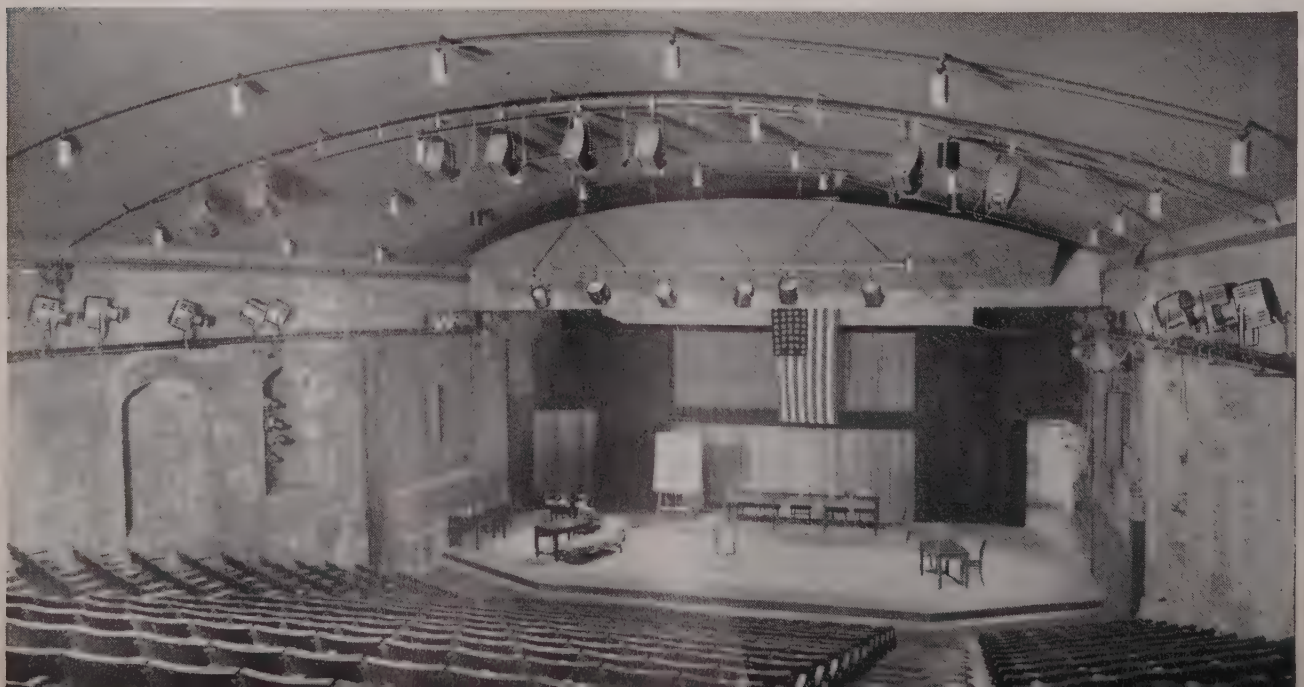
A very large number of these lanterns will in fact be used—several hundred in a modern West End production. One reason for the large number of spotlights is that to get increased intensity of light it is more convenient to use a large number of comparatively small lanterns hanging above the stage than to use fewer bulky lanterns. Another reason is that very often a change of colour may be required on an area and therefore more than one lantern will be directed on to the same place. Yet another reason may be that a different set of the lanterns is used for a different effect in another scene. It must not be thought, however, that each different lighting effect or scene is necessarily carried out by another set of lanterns; the effect is more often produced by using the same set of lanterns and causing some to dominate. By careful arrangement, a layout can consist of lanterns directed at the requisite areas with their intensity regulated by dimmers to produce the effect required.

Thus, in theory one would like a dimmer to every spotlight in the theatre. In practice, however, this would be quite ridiculous since several spotlights are often used over the same area merely to provide more intensity or to shape the area to suit. It is not uncommon, therefore, to find that in a West End theatre four 500 W or two 1,000 W spots are regulated by a single dimmer. Nevertheless, a large number of at least the 1,000 W spots will be individually controlled. Spotlights, when paired on dimmers, will usually be adjacent to one another and very seldom looped right across the stage.

In the stage area, lighting tends to hang from barrels parallel to the proscenium at roughly 8ft centres up and down stage. For repertory theatres, of which the Aldwych is one kind of example, there will be a large semi-permanent layout of lanterns. In the long-run theatre, however, the layout is hung specially for the theatre's particular production and therefore the permanent installation of the theatre will consist only of socket-outlets generally mounted together on boxes in the flies and at stage level and a comprehensive switch and dimmer board. An exception to the rule of providing only socket-outlets is usually made in the case of the auditorium. This is because the auditorium positions are largely governed by the architecture of the place and the available sites are usually filled up.

A considerable amount of light comes from the auditorium and is directed on to the stage. This arises partly because, obviously, only lighting from this direction can provide satisfactory illumination of the actor's face when he is working downstage near the audience. It also arises because of the great tendency now to bring the stage out in front of the proscenium. Indeed, there is quite a movement to do away with the proscenium arch altogether and London has two theatres of this type—the Mermaid Theatre (Fig. 3) which has a stage at the end of the audi-

Fig. 3.—The Mermaid Theatre in the City of London which has no proscenium arch and curtain (house tabs)



torium and which appears pretty normal except that there are no "house tabs," as they are called, and no proscenium, and the Pembroke Theatre, Croydon, which consists of a square stage round which the audience sits on steeply-tiered seating and is known as "theatre-in-the-round."

In general, the centre line of the spotlight beam when depressed somewhere between 35 and 45° from the horizontal gives satisfactory results. Such lighting can then be kept off the backcloth or in the case of a stage surrounded on two or more sides by the audience, out of the eyes of the audience without distorting the features of the actors too much. The kind of position that is utterly useless but unhappily is all too easily provided is that along the front of the circle in a one-tier house, the beam angle is far too shallow and then tends to project shadows everywhere. Control, after all, is not only a matter of control of the area of the beam by varying its size, it is also a question of angling the lantern correctly. To angle and direct it, we need access and the ideal form is some type of lighting bridge in the ceiling of the auditorium. This lighting bridge is parallel to the proscenium in that type of theatre but running all round the stage in a theatre-in-the-round.

Lighting Control

In all modern installations, the dimmers are remotely controlled from a console compact enough to be operated if necessary by one man who preferably is somewhere "out-front" seeing the show as the audience sees it. There is a great temptation to treat stage lighting from the engineer's standpoint and choose the most sophisticated form of dimmer but the dimmer has no importance at all when considered as a single unit; it is only when married together with a number of its fellows that it becomes important. The reason for this is that stage lighting is concerned with the combinational effects of a number of circuits, each of which is controlled relative to the others by means of the dimmers. Lighting is thus a matter of grouping to suit the effect required at the moment.

A good, if crude, example of this is the scene in which the daylight gradually dies in the room leaving the firelight and the night sky outside. Some character then comes in and switches on first one light in the room, then walks over to a table and switches on another. Here we have first the dying gradually on the dimmers of the various spotlight units which made up the day effect. As this group went out so the night sky and the firelight and above all the spotlight which simulated the firelight were left behind. The moment the first room light is switched on a number of the circuits which were taken out have to be switched in to a new set of levels. It may be that one or two new lanterns are brought in as well, but in general much of the lighting will be produced by using the same spotlights in a new grouping and to new levels.

So it can be seen that the switchboard is concerned to provide individual circuits with a means of regulating their intensity over a wide range from virtually nothing to full-up, and to do this in respect of at least two pre-set levels, i.e. so that the next level can be set while the existing lighting is in use. In addition, of course, there is the group movement of several circuits together and there may on occasions be some 120 circuits moving together to form a change in lighting effect. The figure of 120 circuits or channels, as they are called, is representative, but it must be remembered that some London theatres have as many as 216 channels.

Dimmers

In general, there are two types of dimmers, the all-electric and the electro-mechanical. The all-electric forms are the saturable reactor, magnetic amplifier, thyratron valve, and the new silicon-controlled rectifier (s.c.r.). The electro-mechanical forms are either the resistance or auto-transformer dimmer operated by a system of clutch and motor servo from its remote lever. In Britain, the latter is still the preferred system, but saturable reactor dimmers, being the least expensive, are to be found in many small theatres and on some school and assembly hall stages (Fig. 4). The drawback in larger installations is poor

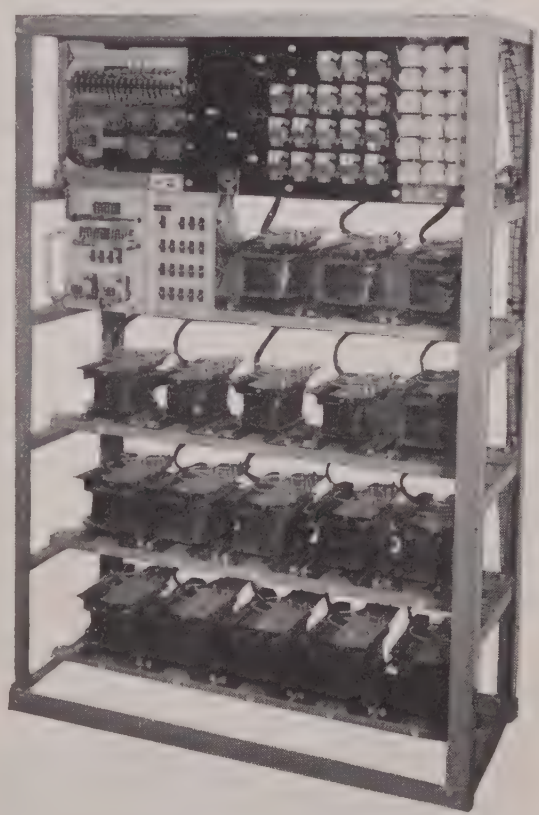


Fig. 4.—Standard 18-channel saturable reactor dimmer rack. A 36- or 54-way installation would be built up of two or three of these

regulation and the comparatively heavy control current required which makes pre-set control difficult. In practice, the performance is improved by including some degree of feedback and a transistorised amplifier, but even so this equipment hardly suits the large theatre. There are several installations using thyratron dimmers but none of them more recent than about ten years ago. The reason for this is that this dimmer did not fulfil its original promise—for one thing it tends to be very wasteful of electricity due to the heater losses and voltage drop across the valves. There are also other undesirable side effects from the chopped waveform which is the method of dimming. Incidentally, these defects are shared by the s.c.r. dimmer, which at first sight seems the ideal solution to the dimming problem, but the removal of side effects

involves quite a degree of complication to the basic circuit and therefore raises the cost.

However, the real reason for the popularity of the electro-mechanical dimmer control system in Britain (Fig. 5), in preference to an all-electric system both in the case of the theatre and in the case of television studios, is the better control afforded. The operator using all-electric systems cannot concern himself solely with channels which have to change in effect, he has to keep the dimmers activated for all the channels that are alight. In America an attempt is made to solve this by increasing the number of pre-sets, ten being common. The trouble with ten pre-set levers for each channel is that when there are 100 channels this means 1,000 levers.

Control Console

The electro-mechanical system scores because once a dimmer has been driven through its servo to a particular level it can be disconnected from the control lever and will remain stationary until next called upon to move. It does not require to be constantly energised. This leads to the different approach which characterises British stage lighting, namely, the organ console type of control. This consists basically of a selector switch in the form of an organ stop-key and a pair of dimmer levers for each channel (Plate D). The two dimmer levers can be used to provide in advance two sets of levels which differ from the one in use at the moment because neither of them needs to be used permanently to hold a dimmer at its station. The stop-keys are used to select the circuits required to change at the moment and thus the combinational effect of a change can be ignored since one would merely pick out the particular circuits required to move. These stop-keys also incorporate a pair of magnets which can be energised through a memory relay to move them on and off automatically. It now becomes possible to select a combination by hand by putting down the stop-keys. If then the master memory button is pressed that particular combination is captured on any one of 14 or 20 memory buttons provided. Subsequent pressure of a particular memory button without the master will cause the stop-keys actually to move to the positions required. It thus becomes possible to select quite complex groups instantly at the touch of a button; further, because the keys themselves move, these can be modified by hand at any time. Once selection is established, the group can be switched or dimmed to any required level by operating the appropriate master switch. It is also possible to move dimmers to "full" or to "out" without invoking either of the two pre-set levels and furthermore other devices enable selected circuits to be brought in while unselected ones are cross-faded out. This system has resulted in very compact controls even where large numbers of dimmers are used and a modification of this, using luminous organ stop-knobs instead of stop-keys for 240 channels at the A.T.V. Elstree Studios is shown in Fig. 6.

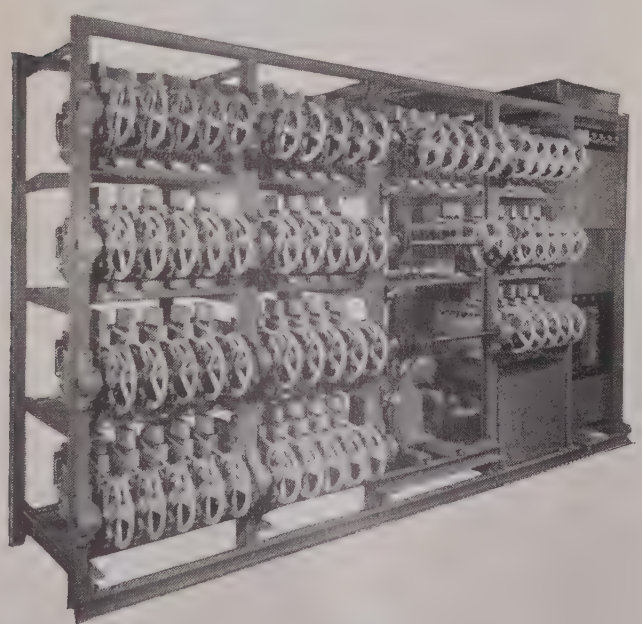


Fig. 5.—Electro-mechanical dimmer bank. One integral unit can be manufactured to cover up to 120 channels

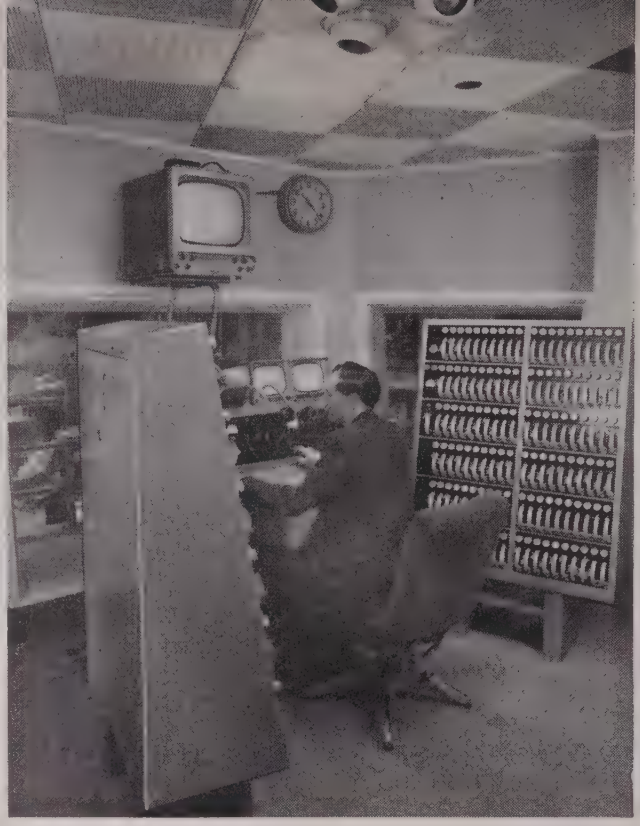


Fig. 6.—Control console for 240-channel electro-mechanical dimmer system in the A.T.V. Elstree Studios

The electro-mechanical system thus provides certain advantages which make one reluctant to embrace all-electric dimmers for large installations until comparable control facilities can be evolved. Being a mechanical system, however, there are limits to the speed at which a dimmer can be moved from "full on" to "off." The common provision is for roughly 2·5 sec dimmer travel down to 45 sec or more by means of a foot pedal, but obviously at times it would be convenient to cut instantly from one level to another, a thing perfectly possible on an all-electric system. What one has to do is to balance the pros and cons and so far the writer believes that the electro-mechanical wins hands down. This seems to be supported by the fact that, for example, every television studio in the country has adopted the system. There remains the question of fully-automated reproduction of lighting. Apart from anything else, cost would seem to rule this out, though a British punched card system of lighting control exists and can be seen in London. However, as no installation exists in a theatre, description is not appropriate here.

New Prospects in Lighting

An important stage has been reached in the history of lighting. From judging an installation solely in terms of foot-candles, the trend is towards an overall assessment of the quality of the light provided in relation to the purpose for which it will be used. Light is also increasingly being considered as a basic factor in the architectural conception. This clearly greatly widens the scope of the illuminating engineer's activities and demands a closer co-operation with architects. The implications of these developments are discussed in the following five articles with particular reference to the new I.E.S. Code

ILLUMINATION AND SEEING

By H. C. WESTON, O.B.E., F.I.E.S.*

WHAT we mean by our general "standard of living" is really a collection of "standards" each relating to a different aspect of living. Most of these change—at different rates—but all of them, we hope, change in only one direction—upwards. Among these "departmental" standards there is no doubt that those of seeing and lighting have risen noticeably within the last 15 years, and they are still rising. The widespread and inevitable optical imperfections of the eyes that can keep down the general standard of seeing have been—and are being—compensated more generally than ever, owing to the advent of a national health service. And the imperfections of lighting that keep down the standard of seeing alike for good and poor eyes have become—and are still becoming—less tolerated and consequently less prevalent.

The recently published new I.E.S. Code for good interior lighting sets higher standards than its predecessors. This is not only because better standards can be formulated, owing to the accretion of more detailed knowledge concerning the effects of different conditions of lighting upon the serviceability of our sight and our comfort in using it. It is also because previous recommendations were not as stringent as the available knowledge could justify but were tempered, to some degree, according to expediency at the time. Now it is both expedient and opportune to set standards "nearer to the heart's desire," and this means taking due account of what people *like* as well as merely satisfying their functional *needs*.

Visual Sensitivity

Potential visual sensitivity is subject to innate limits which differ somewhat from one person to another and at different periods in life. For everyone, however, the prevailing lighting determines "how much" visual sensitivity is actually available for service. The prevailing lighting has a number of characteristics which contribute to its revealing power, or power to release visual potential. Although these characteristics can be considered separately they are, of course, inseparable in any actual lighting installation.

The first, and usually most obvious, is the "strength" of the light, to which alone the term "illumination" is applied technically. Although it has always been patent that seeing is much more detailed and easy in the strong light of day than it is as dusk approaches, the time is not long past when even eye specialists believed that the acuteness of sight reached its peak at a level of illumination no higher than four or five candles will produce on a book placed 1ft away from them. Modern researches have shown conclusively that visual acuity may continue to improve as illumination is increased up to a level hundreds of units higher than this. In terms of the British unit of illumination—the lumen per square foot—the power of the average normal eye to detect fine detail is not maximal until the illumination of the detail reaches about 1,000 lm/sq ft, or a correspondingly higher value if the reflectance of the detail and its contrast with contiguous areas is poor.

High Levels

This does not mean that these high levels of illumination need to be provided indoors, except quite locally and for the few tasks that make the most exacting demands for visual sensitivity which cannot be better, or conveniently, ameliorated by the use of optical aids. Generally, we do not need to have available the utmost sensitivity of which the normal visual constitution is capable. All our physiological capacities—if we are healthy—have upper limits exceeding our usual requirements. Of none is this truer than of vision and, of course, survival is

* Past President, Illuminating Engineering Society; formerly Director of Research in Occupational Optics, Medical Research Council.

contingent on this provision. Moreover, above a certain range of illumination values, or a certain level of luminance (i.e. photometric brightness), our powers of visual discrimination improve but slowly and to a relatively small extent. A few hundreds of lumens per square foot suffice for high, though not quite maximal, visual capacity and quickness of sight. Up to a point, higher levels of illumination can compensate for curtailment of the time available for seeing as, in photography, they compensate for reduction in exposure time. This is most evident when moving objects need to be seen, whether in ball games or in other occupations. But there are few buildings of any kind in which the general illumination by natural lighting exceeds 500 lm/sq ft at any time and, on the average, the indoor daylight illumination—even in well-fenestrated modern buildings—is well below this level. There are technical as well as economic difficulties in providing so high a level of general illumination by artificial lighting and, on grounds of visual performance, it could rarely be justified.

Purpose of Seeing

We see primarily and pre-eminently for the purpose of extracting *useful* information from our environment. This purposeful, or utilitarian, seeing is a source of satisfaction when it is easy in a good light, but is accompanied by displeasure when bad light makes it difficult. But, besides this "feeling-tone" associated with seeing, our feeling of general well-being or otherwise is often influenced—sometimes profoundly—by environmental brightness. This is a fact attested by such universal experience that it need not be laboured here. The hedonic aspect of lighting is, in fact, sometimes more important than the utilitarian and is nearly always too important to be overlooked. It is very much a matter of levels of illumination. The more light we have—short of general field glare—the better we like it in some circumstances, for it is cheering and exhilarating. Contrariwise, a little light is more conducive of pleasurable feeling in other circumstances, such as the expression "soft lights and sweet music" suggests.

There is no doubt, however, that in many places of work the creation of an agreeably bright environment calls for a higher general level of illumination than is necessary for the comfortable and efficient performance of the particular visual tasks involved. What does this level need to be; tens or hundreds of lumens per square foot? Already a loose answer has been given—the higher the better, subject to the avoidance of glare.

Adaptation

Here, however, something needs to be said about adaptation. Everyone knows that on leaving a very highly illuminated environment and entering a much more moderately illuminated room the first impression is one of dimness. In a short while the brightness of the room appears considerably higher and, when the eyes are fully adapted to it, the final impression may be one of quite pleasing brightness. On reversing the sequence, the first impression of the highly illuminated environment may well be one of glare, but the apparent brightness decreases as the process of adaptation proceeds until, finally, the environment appears agreeably bright and non-glaring. Because of this most important adaptability of the visual system, an agreeably bright working environment can be produced by tens of lm/sq ft, provided the environmental surfaces that have to be brightened are light in colour. The new I.E.S. Code recommends that the illumination provided for this purpose—the "amenity" illumination—should be at least 15 lm/sq ft. In many working interiors it is desirable to double this value because of the low reflectance of the structural surfaces and of the contained equipment. In any case, the euphoric effect of environmental brightness is likely to be enhanced where the general illumination level exceeds the recommended minimum by a factor of $\times 2$ or $\times 3$. But between the brightness afforded by such a level and that provided by ten times the minimum illumination the effective gain is not large, once the eyes have reached a steady state of adaptation. Still smaller will be the apparent gain in brightness produced by yet higher levels of environmental illumination; and it is interesting to note that the level to which the adapted eyes respond with a maximum luminous sensation (not necessarily most agreeable) is also the level at which the powers of visual discrimination are maximal.

Viewing Solids and Colours

Seeing the form and texture of solid objects most easily depends upon the proper use of directional lighting, so that a suitable pattern of light and shade is formed. Many things are easier to see with a little light skilfully directed on to them than they are in a flood of diffuse light. The method of lighting, and not only the level of illumination, needs, therefore, to be chosen with full regard to the nature of the objects it is intended to reveal.

The utility of vision generally depends much less upon the discrimination of colours than upon the perception of brightness differences. Nevertheless, colour vision is helpful as well as pleasurable, and illuminants which grossly misrender the colours of objects are not agreeable for ordinary use, although they do no harm to the eyes. However, the appreciation of colours and their differences is satisfactory for most purposes, and the appearance of colours is acceptable to most people, under various illuminants which are broadly classed as "white" lights. When immediate comparison can be made between the colour rendering of these illuminants preferences are usually formed but, otherwise, acclimatisation to any one of them is usually not difficult and ordinary seeing is not measurably more or less efficient with any of them. This is not surprising, since there is no natural standard illuminant.

Daylight varies in its colour quality both hourly and seasonally, and the tolerances of the human visual system are wide enough to permit good seeing with a range of illuminants as well as of illuminations. Moreover, the intrinsic quality of the artificial lights now in common use has never been shown to have any harmful effects upon sight, although it is possible, of course, for any bright light source to be glaring if it is misused. This aspect of lighting design is dealt with by Mr. Robinson in the following article in this symposium.



New Prospects in **Lighting**

COMBATING GLARE

By W. ROBINSON, B.Sc., A.M.I.E.E., F.I.E.S.*

GLARE, like the poor, has always been with us. The motorist driving into the sun suffers an intense form of it, as does the motorist meeting headlamps at night. In both cases there is considerable discomfort, accompanied by a reduction in vision which may amount to virtual blindness. Ordinary interior lighting, fortunately, is never so bad as this but exposure to what glare exists may be prolonged, and its effects are cumulative.

It may seem remarkable that it has taken half a century to evolve a practicable system of glare control such as is contained in the 1961 I.E.S. Code but, as with all subjective phenomena, research is time-consuming and the statistical interpretation of the results of subjective tests is equally so.

Strangely enough the first problem of glare is that of recognising it. Remedies for obvious glare are themselves obvious, but in most cases glare reveals itself through an ill-defined sense of dissatisfaction and strain after prolonged exposure to it. The factors which combine to produce discomfort glare have been known for a long time. They are, for each light source, its brightness and area in the direction of view; the brightness both of the immediate vicinity of the source and of the room as a whole; and the location of the source relative to the observer. It is only quite recently, however, that a measure of international agreement has been reached as to the relative contribution of each of these factors to the overall glare effect.

The glare index system in the 1961 I.E.S. Code is based on a relationship determined after extensive research by Dr. Hopkinson and his colleagues at the Building Research Station. Glare indices covering all *general* lighting installations (as distinct from special forms of interior lighting) have been calculated from this relationship by the use of an electronic computer (which performed calculations representing over 20 years of human effort). Limiting glare indices are scheduled alongside the illumination recommendations in the code and hence become an integral part of the I.E.S. Specification for good lighting. The main purpose of this article is to discuss the implications of this totally new development.



These two lighting installations illustrate the complexity of the problem of glare estimation. Although they are totally dissimilar in technique and appearance only calculation would indicate in advance which would be the more comfortable

Glare and Lighting Engineers

Lighting engineers have hitherto relied on their accumulated "know-how" in designing comfortable lighting but they could not always convince their clients that the extra

* Technical Officer, British Electrical Development Association.

cost of anti-glare measures was justified. One reason for this was that the engineer had no official backing for his proposals and hence the client's word was as good as his own on the point of quality. This usually resulted in lighting which satisfied no one except, may be, the cost accountant. The new recommendations will now remove from the engineer the burden of justifying anti-glare proposals since they are necessitated by the Code. This presupposes that the lighting user accepts compliance with the I.E.S. Code as his guarantee of satisfaction with his investment in lighting; those users who do not accept the authority of the Code will at least know where the blame lies should their lighting fail to come up to expectations.



Glare control of fluorescent fittings by specular optically shaped louvres and reflectors. Although the fittings shown have a strong downward light emission their brightness is no greater than that of the ceiling

Most blameworthy of all, however, will be those engineers or organisations who seek competitive advantage by submitting lighting schemes which do not conform to Code recommendations. For them maybe a quick profit now but, we hope, no future.

Design of Fittings

A novel and highly important aspect of the I.E.S. glare index system is that it has nothing to say about the design of lighting fittings as such; no brightness limits or height limitations are suggested. Any sound present-day lighting fitting can be used somewhere in full compliance with the Code, *but very few can be used everywhere*! The limitations are imposed by the nature and purpose of the rooms themselves; they are limitations on the lighting engineer rather than the fittings designer, but fittings manufacturers who want to stay in business will have to anticipate the effect of all this on the demand for their fittings and we can expect, by a process of natural selection, the gradual disappearance of some old favourites and the emergence of new and, as it were, more finely bred varieties.

Effect on Lighting Practice

The 1961 I.E.S. Code is bound to lead to fundamental advances in lighting practice generally. Many of these, such as the recommendations on permanent supplementary artificial lighting, will take some time to develop, but the glare recommendations can, and should, be applied forthwith. This is particularly necessary in the case of the plethora of office buildings now in course of erection. There was previously some excuse for the qualitatively sub-standard office lighting which has been a depressing feature of many new office buildings, but there is none for its repetition now that glare control data are available. Much the same can be said about factories.

The form of the I.E.S. glare data permits some crystal gazing with a higher degree of probability than that usually associated with this pursuit. It is, for instance, obvious from simple inspection of the data that: —

A relatively narrower distribution of fittings is going to be required for large interiors than is now usual.

Devices other than fittings distribution control, such as increasing upward lighting components or redecorating, can alleviate glare only within limits.

Diffusing fittings, whether tungsten or fluorescent, become less satisfactory as room sizes increase. The orientation of fluorescent diffusing fittings is a critical factor in long rooms.

The room size plays a dominant role in this, for as rooms get larger so the permissible beam spread of fittings (indicated by their B.Z. classification) tends to decrease. The combination of a large room and a low permissible glare index could well lead to underlighted walls and an unfortunate association of visual comfort with gloom. It is difficult to see any remedy for this other than supplementary perimeter lighting and it appears highly probable that the present attempt to obtain from a single type of fitting both visual comfort and brightness in a room will give way to two-part lighting installations using narrow-beam central fittings to produce the required illumination and specially-developed perimeter light fittings to provide the desirable surrounding brightness. This is not new in architectural and display lighting, but the technique is applicable to more routine applications. Certainly we can hope for the early demise of the large and distracting array of overhead luminous fittings.

Glare and the Architect

A very useful feature of the glare index system is that it enables architects to be provided with a forecast of the effect, as regards glare, of the lighting fitting of their choice. This may well be more important than the simple reduction of glare in cases where the appearance of the lighting equipment is a major consideration, for to many architects, and legitimately in certain circumstances, appearance and visual comfort are considered in the order given. It may well be that, with a little give and take, more marriages can be arranged between the engineer's predilection for comfortable lighting and that of the architect for good-looking lighting equipment. Under-

standing and agreement between engineer and architect will, no doubt, be further promoted through the ability to demonstrate, in commercial terms, the precise effect on visual comfort of proposed decorative schemes. It is not suggested that this revelation will necessarily lead to an alteration in course (after all do we want decorations or architecture to be wholly subordinated to comfort ?), but it will enable the lighting engineer to absolve himself from the consequences of some of the worst excesses just as it will permit the architect, if he so wishes, to flout convention by design rather than by accident.

Quite obviously the above considerations apply equally well to the engineer in relation to any of his clients who may be similarly disposed.

A Matter of Specification

Some concern has been expressed that glare index recommendations in the Code are maxima with no mention of tolerances. In this respect they differ from illumination recommendations, for which some tolerance has always been allowed.

The full *normal* range of glare discomfort, however, is encompassed in a glare index range of 10-31, as compared with an illumination range from 2-1,000 and over, and a relatively small increase in glare index can produce a noticeable increase in discomfort. If the lighting industry offers lighting schemes designed to the 1961 I.E.S. Code and the customer demands I.E.S. engineered lighting then the question of tolerance does not arise. This eminently desirable state of affairs need not exclude the exceptional cases when the customer's firm requirements cannot be met within the Code glare index limits. In such cases the customer can be advised in advance of the effect of meeting his requirements and tenderers can safeguard their reputations by so advising them.

The foregoing procedure would have been considered impossibly Utopian only six months ago. If, as may be expected, it should come to be regarded as the sensible way of doing business then the herculean task of producing these glare indices will have been well rewarded. But there is much missionary work to be done, not only by the lighting industry but by the electrical industry as a whole before the 1961 I.E.S. Code can become as familiar to lighting users as to lighting providers. The sooner this happens the better for all concerned, and not least for the great majority of working people who have come to accept glare of one degree or another as an inevitable feature of their environment.

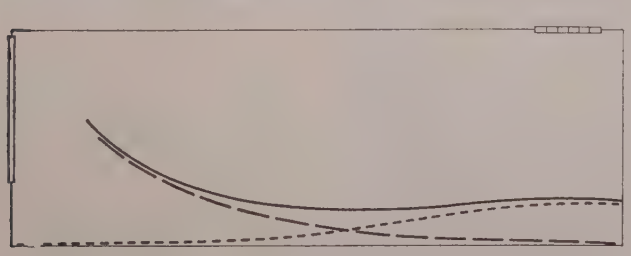
New Prospects in **Lighting**

THE DAYTIME USE OF ELECTRIC LIGHTING

By A. WILCOCK, A.M.I.E.E., Dip.M.I.E.S.*

IF one were to summarise in a few words the major developments in lighting over the past 20 years or so one might refer to the transition from the five to the 50 lumens per square foot installation. True, the latter is not universal, but it is common enough, particularly in industry and commerce, to make the standard a good talking point when discussing any new installation.

Electrical people interested in the business as well as the science and art of lighting can be forgiven for doing mental arithmetic and thinking of installations which are many times as profitable as they used to be in lamps, fittings, and energy sales. Even at this first approximation the transition makes good lighting a rewarding enterprise. But since the need for more light brings with it the need for higher standards of quality (principally reduced glare), the first approximation can be re-assessed to embrace better fittings and the many subtleties of good design which are denied when the only objective is to get a little light on to the working plane.



Room 28ft deep with 10ft ceiling. Minimum daylight factor 1 per cent

Broken line—illumination provided by daylight. Dotted line—illumination provided by P.S.A.L.I. (50 lm/sq ft max.). Full line—illumination provided by both sources together, resulting in an acceptable brightness pattern within the room as well as adequate working light everywhere

And yet, important though these direct quantitative and qualitative achievements may be, the next few years could see them overshadowed by a development which might sound to some as though it came straight from the pages of "Alice in Wonderland"—the daytime use of electric lighting. The thought of an artificial illuminant to challenge the sun is something at which the mind boggles, but, of course, direct sunshine is something which, for several very obvious reasons, is discounted in natural lighting planning. Design is on the basis of daylight factors usually of the order of 1 and 2 per cent, meaning that at some particular point in a room 1 or 2 per cent of the daylight available out of doors (direct sunlight, if any, being excluded) is being obtained. Since the convention is to do daylight design assuming the daylight outside to provide 500 lm/sq ft (the value at which daylight by tradition just manages to be acceptable in quantity) a 1 per cent d.f. means 5 lm/sq ft, and 2 per cent d.f. 10 lm/sq ft inside. It is clear that the solution

* Director, British Lighting Council.

of lighting problems by daylight alone is not something for the 50 lm/sq ft era.

What is the answer—the windowless solution ? Perhaps not. Daylight is regarded by most as a " good thing " and it is generally assumed that for the great majority of applications the total substitution of artificial lighting for daylight should be avoided. A partially windowless treatment adopted in commercial blocks in the United States has interesting possibilities. In this the perimeter areas are devoted to high-level executive offices, thereby giving important people the prestige symbol of a view (neighbouring skyscrapers permitting). Central areas are given over to typing pools and the like, and well-designed artificial lighting of high illumination value (100 to 150 lm/sq ft) appears to be acceptable to the occupants.

However, the most interesting solution to emerge in this consideration of the present-day relationship between natural and artificial lighting is that by the Building Research Station, which goes under the title of " Permanent Supplementary Artificial Lighting for Interiors."* Their approach is from the basic premise that daylight should dominate and that artificial lighting should be used to supplement it in those parts of the building where the daylight is inadequate. As an example, the common enough situation of the multi-storey block with windows down one long wall might be met by introducing permanent artificial lighting via a ceiling panel in line with and close to the opposite wall.

Not the least interesting aspect of permanent supplementary lighting is the amount of illumination to be provided artificially. Because of the physiological and psychological effects of window glare the illumination provided must be greater than would normally be considered adequate on a straight visual performance basis. The actual optimum value can be calculated from considerations of daylight factors using the formula $E=50\ D$ lm/sq ft where E is the level of the supplementary lighting and D the minimum d.f. over the area for which supplementary lighting is being provided (e.g. if D is 1 per cent, then $E=50$ lm/sq ft.

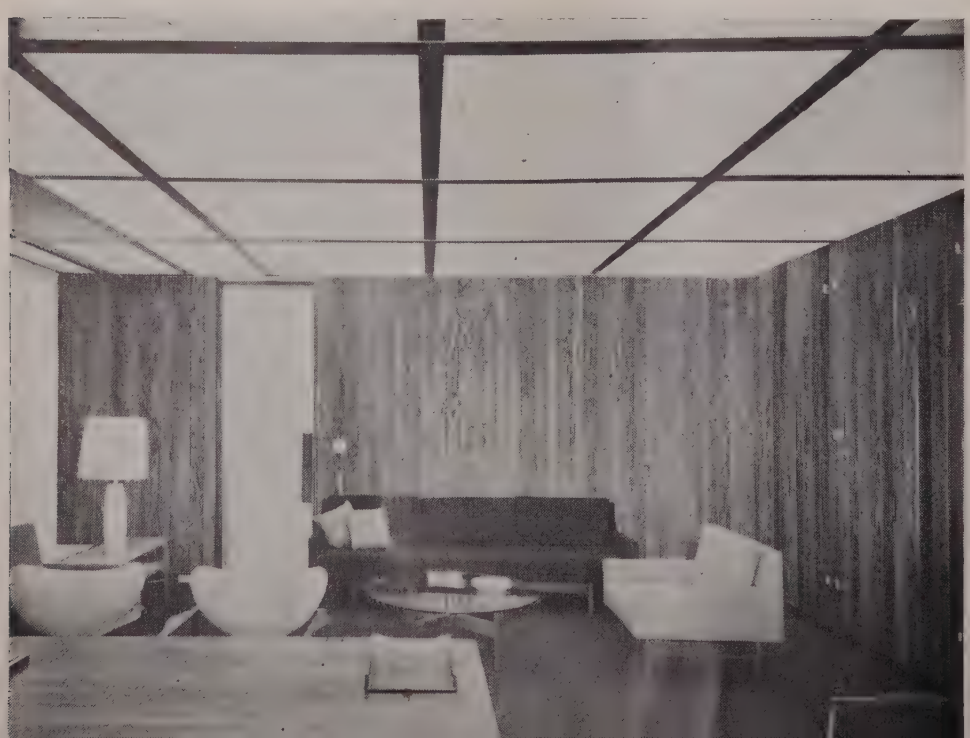
The above expression, an approved approximation, will lead to results which are satisfactory for all but the dullest days. Anybody wishing to make a proper study of the system should, of course, refer to the original text, and here he will find confirmation that 50 lm/sq ft is a reasonable target figure in modern lighting practice.

But in addition to its spacial relationship in a building, daylight has an important one of time. It changes in quantity from dawn to dusk, and as the appetite for lighting increases so does the period of time for which daylight alone is adequate decrease.

Let us consider a situation in the commercial world based upon daylight curves produced by the National Physical Laboratory for Edmonton and Teddington, near London. The table assumes a daylight factor of 2 per cent and shows the extent to which artificial lighting must be used in order to preserve the particular standard adopted. An interesting figure is the 50 per cent usage for the I.E.S. recommendation of 30 lm/sq ft. It strengthens the argument for good artificial lighting when it can be pointed out that it is necessary for half the normal working day and, of course, vital to overtime. At 50 lm/sq ft we are approaching complete dependence —an interesting situation for the electricity supply man used to thinking of lighting as a peak load only.

The term " complete dependence " perhaps needs some qualification. As has been stated, it does not mean windowless buildings but rather buildings in which windows are used for the thing they do best, i.e. to provide a view of the outside world. Perhaps in the face of this architects will forsake their clerestory approach and their passion for daylight penetration, and re-think in terms of permanent supplementary lighting which might offer them more satisfactory solutions to some of the problems with which they are faced. Ceiling height and room depth from window to back wall would be less interdependent; rooms could be made deeper and buildings not so tall and slim; division of the internal space

* See I.E.S. Transactions, 1959, Vol. 24, No. 3.



One of the offices of the Seagram Building, New York, illuminated to 125 lm/sq ft

ANNUAL HOURS OF USE OF ARTIFICIAL LIGHTING
Office with normal five-day week. Minimum daylight factor 2 per cent

Illumination to be maintained (lm/sq ft)	Hours of artificial lighting necessary	Per cent of total possible working hours (2,150)
10	338	16
20	795	37
30	1,075	50
40	1,420	66
50	1,740	81
60	2,150	100

could be arranged without reference to daylighting needs; there could be less loss of internal heat. The adoption of wide low windows, possibly tinted to reduce sky glare and direct solar gain, should be investigated, for they might in fact enable the whole site to be more economically utilised.

The challenge to the lighting engineer of the new prospect in artificial lighting brought about by daytime use is very great. He has to provide 50 lm/sq ft or more with comfort—the new I.E.S. Code could not have come too soon in this connection. He has also to attempt balances of light distribution and colour and to ensure that whatever system he adopts meets the need of night-time as well as daytime use. This needs careful handling: in addition to the changes in quantity necessary, many feel that the transition from day to evening calls, on occasions, for some change in the colour and the means by which the light is introduced.

Overall it means an increase of professional responsibility. The artificial lighting installation, from being a few lights here and there, has developed into something of a science and art which has a great deal of influence on what happens in a building during the whole of its use. It is 5 to 50 lm/sq ft, and a lot more besides. The prospects in artificial lighting are greater than ever before.

New Prospects in **Lighting**

THE RELATIVE COST OF LIGHTING

By A. D. S. ATKINSON, A.M.I.E.E., F.I.E.S.*

"LIGHTS to Cost More" shouted a London evening newspaper when a recent revision in electricity tariffs became known, reflecting fairly accurately the way the cost of lighting is generally assumed by the public to be a major item in their electricity bills. In fact, the extra lighting cost that this revision involved was something less than a penny a week.

Nearly everything that makes the present-day mode of life possible gets more expensive year by year and the rise is generally accepted, though grudgingly, as being in some way due to the improved standard of living. Lighting today is unique in being at about its cheapest point ever. True, this may not be appreciated by the man in the street, for he seldom has any idea how much lighting costs him on its own, or how much in relation to the television and other electrical devices. Certainly he has no inkling of the good value he is getting from lighting at today's prices.

Inadequate Domestic Installations

Take, for example, the ordinary household. Some people spend more (in the form of window cleaning) for daylight than they do for electric light. The average householder spends only about 1s 1d† a week on lamps and current for lighting, and though for this meagre expenditure he can hardly expect very much, he at least gets some light in some of the places where he needs it.

If he cared to take advantage of a two-part tariff, where available, and if he also had an adequate lighting installation, he could get double the lighting service he at present enjoys for an extra few pence a week. But the average domestic lighting installation is not adequate to provide even what is now regarded as the barest minimum of lighting, and could hardly be otherwise when only about 1 per cent of the total building cost is allocated to it. If local authorities and private builders could be brought to realise that adequate home lighting facilities demand a 3 per cent allocation at least, there could be sufficient socket-outlets installed to change the domestic lighting scene for the better very quickly.

It is estimated that at the present time only about 4 per cent of electrified homes have fluorescent lighting in the kitchen. Were this percentage only to be doubled, another half million households would get several times as much light with no immediate appreciable change in their costs or the nature and duration of their electrical demand; but they would considerably encourage themselves by their own example to upgrade the lighting elsewhere in the house. Kitchen and living-room lighting usually comes on at about the time of the evening peak load, but that in other parts of the house at other times; thus any all-round improvement in home lighting is unlikely to have any adverse effect on load factor, and may even improve it.

Capital and Running Costs in Offices

An analysis of some office costs is revealing. Taking, for example, a typical 30ft by 18ft room in an office block, lighted to the recommended 30 lm/sq ft level by enclosed fluorescent diffuser fittings, the annual capital cost of the installation plus fittings (on a 10-year basis, with interest at 5 per cent) is likely to be about £30. With electricity at the average price of 2¼d/kWh and a typical minimum daylight factor of 1 per cent, the annual cost of lamps and electricity will be about £12.

It could be argued that this particular type of fitting is rather on the expensive side compared with those cus-

* British Lighting Council.

† Derived from Utilisation Research Report No. 7, Electricity Council, January, 1958.

tomarily installed in a general office; but it must be remembered that all existing office lighting installations were completed before the I.E.S. glare data became available, which show much of the cheaper equipment to be unsuitable for an office of this size. If this ratio of capital to running costs (about 2½: 1) is recognised, it is an obvious encouragement to the consumer to use his installation to the full, apart altogether from the fact that with increased use the average price for electricity may be reduced.

Other costs for the same office are likely to be of this order: —

Total cost of building at 137s per square foot ...	£3,700
Combined rent and rates	approaching £1,000 p.a.
Salaries of ten staff at £8 10s per week	£4,420 p.a.

The annual capital cost of good office lighting thus appears to be less than 1½ per cent of building cost, and the annual running cost to be just over one per cent of rent and rates, or one-quarter of one per cent of salaries.

The lighting in any workroom or part of such a room is generally switched on whenever it will give a significant boost to the available daylight. It follows that better lighting automatically means longer hours of lighting because lights are switched off later in the morning, switched on earlier in the evening and may be required all day, at least in winter, in the areas worst served by daylight.

In the case of the office quoted above, for example, if the illumination to be maintained is only 10 lm/sq ft (which is at least as high as the average level for electric lighting in offices today) the overall lighting load factor would be only about 4 per cent. If the maintained level is to be the recommended 30 lm/sq ft, lighting at the far side from the windows will be on almost continuously, that for the middle of the room for most of the time, and only the row of fittings nearest to the windows will be limited to 200 hours or so of use a year; the overall office load factor is then about 12 per cent. When office lighting is improved, the load factor can be expected to improve in roughly the same proportion (up to a maximum load factor of about 30 per cent) and this is surely a double incentive for those seeking to sell more units.

If the idea of permanent supplementary artificial lighting of the inner parts of rooms (see Mr. Wilcock's article on page 375) were to be taken up widely, the load factor might be further improved and the office lighting evening peak—such as it is—would be flattened and could even become a depression, since this system demands a higher level of electric lighting in daytime than after dark.

Small Percentage of Industrial Wage

Broadly, the picture of industrial lighting is similar to the office lighting one. For his I.E.S. jubilee lecture, Mr. A. N. Irens prepared a summary of lighting costs over a wide range of industries with illumination values ranging from 15 to 50 lm/sq ft. Taken as a whole, lighting costs represented only 1·37 per cent of wages payable for the period during which electric lighting was used; but it is well known that at the levels of illumination commonly used in industry at present, an improvement in lighting has a beneficial effect on production, spoilage, accidents, morale, labour turnover, etc., out of all proportion to the money spent on it.

A minority of those industrialists with unsatisfactory lighting may still quite honestly believe that their existing lighting costs are as heavy as they can bear. Yet to a detached observer it is difficult to understand how it can be economic to pay wages plus 50 per cent for overtime working, if it is considered uneconomic to pay wages plus, say, 2 per cent (for lighting to enable the work to be done efficiently) during ordinary working hours.

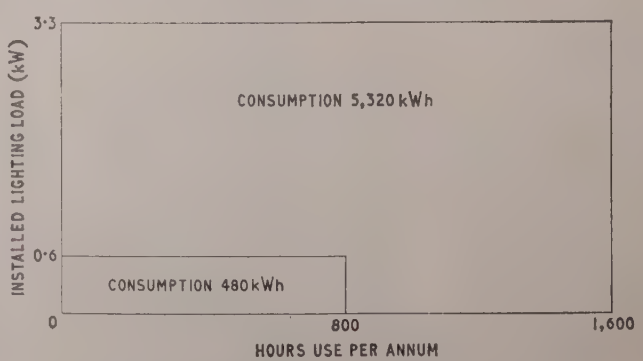
Shops and Load Factor

There are about three-quarters of a million shops in this country, the great majority of which have a connected interior lighting load not greater than 1 W/sq ft. This is in sharp contrast to the 6 to 8 W/sq ft installed in some of the most modern shops, and the 10 W/sq ft coming over the horizon.

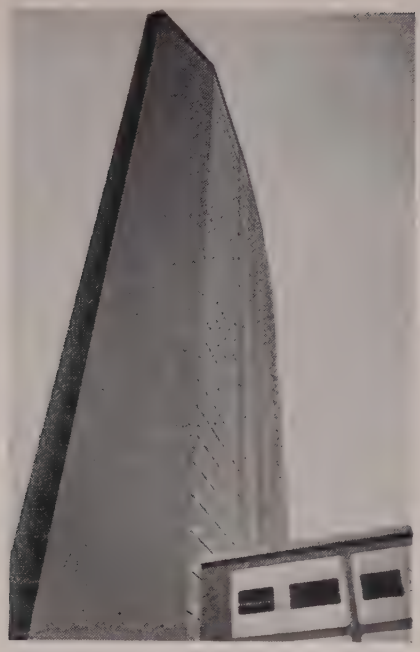
It is commonly said that shops in general do not use daylight nowadays because it is not a good selling light, but in fact many of the smaller badly lit ones evidently do try to rely on it. The graph shows the result of a survey of 347 shops by the South Western Electricity Board in 1953. In 280 of the shops the average interior lighting installed was 0·6 kW, with a consumption of 800 kWh per kW and a load factor of 9 per cent; the other 67 had an average of 3·3 kW installed, a consumption of 1,600 kWh per kW and a load factor better than 18 per cent. Though there has certainly been an all-round improvement in shop lighting in the last eight years, it is evident that in this field too a bigger load means a better load factor.

Observation shows that even in the main streets of large towns many of the shop windows are not lighted in daytime and even more are unlighted after hours. But with vigorous promotion, each window has a potential load factor of over 50 per cent.

Forty years ago the evening lighting peak in the load curve was so narrow and steep that any considerable increase in lighting demand would have had its terrors for the electricity authorities, but today the position is very different. Lighting is now a relatively long-hour load, becoming longer with each increase in the public appetite for light and with each development leading to its greater daytime use. And it continues to pay a large share of the fixed charges, which enables electricity for other purposes to be offered at unusually attractive prices.



Installed load and annual consumption of 347 shops



The Pirelli Building, Milan, is a remarkable synthesis of day and night appearance



Osram-Milano photograph

THE PRACTICAL IMPACT: AN ARCHITECT SUMS UP

By DEREK PHILLIPS

A.R.I.B.A., M.Arch.(M.I.T.), B.Arch.M.C.D.(L'pool)

IT is not so much what has been said in the previous articles that needs summary by an architect, but what has not been said. They have dealt with the three important advances which the new I.E.S. Code makes over the previous (1941) edition, namely, increases in illumination levels, control of direct discomfort glare, and permanent supplementary artificial lighting, while Mr. Atkinson has explained the practical advantages to equipment manufacturers and power authorities inherent in rising standards of illumination.

This is where the I.E.S. Code is on its strongest ground: in delineating the limits of design for visual purposes—the true nature of an " engineering code " for engineers. But whereas some architects act as their own lighting engineers, in the main few will be likely to consider it worth their while to make the necessary study for a complete understanding of the principles concerned.

It is in the architectural implications of lighting that the Code is unfortunately weak, for although it devotes space to what is described as " revealing form and texture " this section is inadequate at best and at worst directly harmful. Much of the advice is impossible for an architect to visualise and the criteria given are generally derived from daylight, a debatable basis for the design of artificial lighting for modern structures. In reading this part of the Code a strong impression is gained that the experience of those who have written it has been limited to " the lighting of architecture " rather than " the architecture of light."

The Architecture of Light

If this short review of new prospects in lighting is to have any crux at all it is that we have now the opportunity to go beyond the " lighting of architecture " interpreted as the lighting of a static building form predetermined from formalistic or daylight technological reasons, an entity " to be lit " . . . to go beyond to a new " architecture of light " in which both daylight and artificial sources are considered as basic design factors in determining the " initial " form of the space, an integral aspect of the whole architectural unity from which nothing can be omitted without lessening the impact of the whole. It is only with recent developments in light sources and the comparatively low cost of artificial light that this sort of

approach has become feasible. The requirements of vision can be provided with a new ease. It is no longer necessary to engineer light so that all the available energy is concentrated on the task of providing light for seeing; a percentage must be used for ensuring that the conditions for seeing are comfortable (this is already widely accepted). In addition, light cannot be considered wasted if by its use a synthesis of form, materials and light assists the architect to modulate space for specific architectural objectives.

There are already some buildings in which this approach is evident, although comparatively few are in this country. The Pirelli building in Milan is an outstanding example. Gio Ponte, the architect of this remarkable building, talked early in the planning stage of a " second aspect of architecture "—the appearance a building takes on from the functions within when it is in use at night. This was no dead floodlighting scheme as we generally know it; it was the living expression of the building in use and it governed the form in the original planning stage. The architecture itself emerged from the basic criteria of daylight together with artificial light, each used in its appropriate context, with regard to the other disciplines of " commodity " and " firmness " without forgetting " delight."

Artificial Environment Expressed

The architect today is perhaps more concerned with commodity or convenience than in any previous period, if this can be taken to cover all those aspects of climatic and other controls which are the essential ingredients of modern structure, controls which often determine the ultimate appearance of the interiors of buildings. The actual form taken by the lighting equipment is as much governed by the needs of air conditioning, acoustics, partitioning, and fire control, as it is by the need to provide x lm/sq ft on a working plane. This is the essence of our artificial environment which is seeking expression in architectural terms.

An interesting example can be seen in the new Coutts Bank in the City, where the ceiling over the banking hall combines daylighting from concealed laylights above, with artificial light, ventilation openings and acoustic tiles for sound control. Later this may come to be regarded as a crude expression of the artificial environment but it is a statement in present-day architectural terms, as far from the usual conglomeration of individual light fittings fighting with every other individual control, as the jet aircraft is from piston flight.

In the United States where air-conditioned buildings are made more necessary by severe climatic changes, lighting units are already available which can serve as input or exhaust outlets for ventilation systems, and there are types of luminous film available for diffusing light which have sound control properties. We may not yet have reached the point at which we can paint light on the walls, but we have gone a fair way along the road towards a freedom for the architect and designer to think in terms of lit space rather than the anachronisms to be found in the catalogues of the majority of light fittings manufacturers.

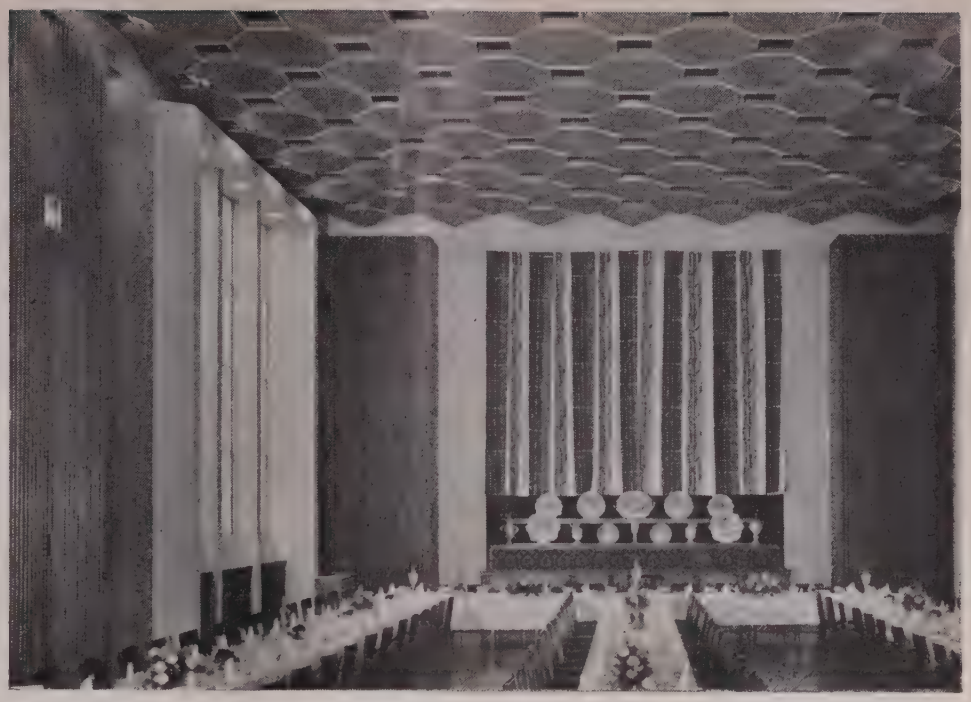
Functional and Decorative Equipment

There is already a logical division of lighting equipment into the functional and the decorative. Very few fittings achieve both these properties; fittings which are truly





" An expression of the artificial environment." The ceiling of Coutts Bank, Lombard Street (detail above), includes day and artificial lighting, acoustic and ventilation controls. (Architect: Hon. Lionel Brett. Lighting fittings: Courtney, Pope (Electrical), Ltd.)



In the banqueting hall of the Carpenters' Livery Company the main lighting is from Troughton & Young downlights concealed above openings in a three-dimensional wooden ceiling. Other concealed lights flood walls and ceiling. (Architect: Austin Hall. Lighting consultant: Derek Phillips)

decorative are seldom efficient enough to be considered functional, whilst functional fittings designed also to be decorative generally succeed in looking silly.

The individually-styled functional lighting fitting is on the way out, to be replaced by the anonymous row or the ubiquitous fluorescent batten, which can serve in so many capacities closely related to architectural detail. In the United States square fluorescent panel lights are making their debut (see page 387), and although these are small as yet (1ft square), larger units will surely follow. To cope with the problems of high brightness when higher illumination levels are required, a new low brightness 1in cell metal-finished louvre is now available which enables very high intensities of lighting to be planned within the I.E.S. glare limits. For closely controlled directional lighting the tungsten lamp still has a considerable future, either as an integrally silvered lamp, such as the pressed glass lamp with its aligned filament, or in the more sophisticated "downlight" unit in which a beam of light is crossed through a small opening baffled by dark horizontal louvres and no brightness is visible from normal angles. In the banqueting hall of the Carpenters' Livery Company, downlights provide the functional light for dining, whilst other fittings at the sides flood the walls and give a specific pattern of light and shade to the three-dimensional ceiling.

There will always be a need for decorative equipment and the more decorative the better. The combination of coloured glass and shiny metal surfaces will be exploited further in this field, but it is probably fair to say that if 80 per cent of the present contents of fittings manufacturers' catalogues was to be deleted, the world of architecture would not miss it a bit.

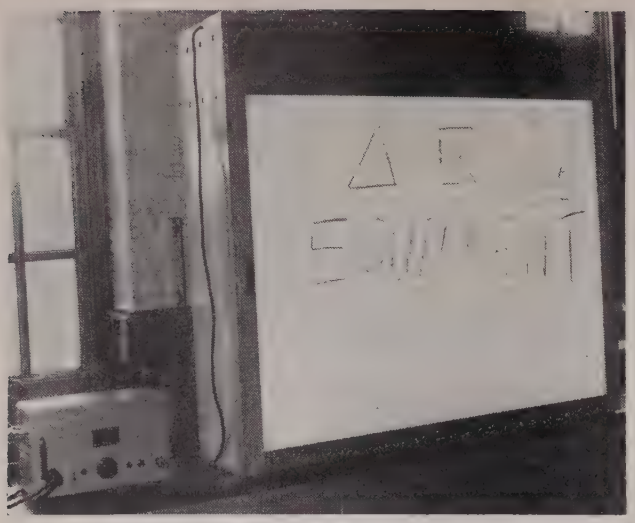


Architect's Journal

Concourse at Gatwick Airport. General lighting is provided by runs of fluorescent lamps above wired-glass louvres. These are serviced from above. Local lighting gives emphasis to individual weighing stations and kiosks. (Architects: Yorke, Rosenberg & Mardall)

Responsibility

Mr. Wilcock talks of "an increase of professional responsibility" but it is not clear on whose part. If it is on that of the lighting engineer then much needs to be done by that profession to improve the standard of education to cope with the increase in architectural possibility. The present City and Guilds course for the lighting engineer has shown itself to be totally unrelated to the new concepts of the "architecture of light" and though it may satisfy the needs of the lighting profession in terms of photometry and lighting physics, it has proved itself to be virtually useless in producing the calibre of man who can assist architects to come to terms with the basic lighting problems of modern building programmes. If, on the other hand, Mr. Wilcock means an increased professional responsibility on the part of the architect, he is hitting very near his target. This is the ideal where each new product of the architectural schools emerges with a knowledge not only of the light sources at his disposal but also of the desirable aims to be achieved in their exciting future.



Self-Illuminated Blackboard

By RICHARD W. SHAW*



A Teaching Aid for Partially Sighted Children

The problem of enabling partially sighted children to read words on a school blackboard was met by writing in charcoal on a specially prepared glass screen illuminated from the rear

PARTIALLY sighted children have extreme difficulty in reading words which are written on a normal type of school blackboard: they can only read a word or sentence by spelling it out letter by letter. The child while so doing is standing one or two metres from the board. The problem was to provide a teaching aid which would enable a child to scan a complete word or sentence. Also, any controls which might be necessary had to be very simple and capable of operation by the children themselves should the need arise. The unit is used for personal tuition since in schools of this type the classes contain children of all ages. The first installation described here is in the Ryder School of the London County Council but the use of this unit in other L.C.C. schools for partially sighted children is being studied.

Preliminary discussions with Mr. Lambe of the chief engineer's department, London County Council, were based on some experiments which had been carried out in Germany, and they ranged from the possible use of a blackboard illuminated by electroluminescent panels to one which would be back-illuminated by fluorescent tubes. Some form of dimming control was also thought essential as there was uncertainty at this stage about the results and the reaction of the children.

It was decided that the electroluminescent panel in its present limited size and relatively lower brightness would not be suitable for the blackboard. It was therefore suggested that a prototype back-illuminated board should be manufactured by the L.C.C. in accordance with information supplied by Atlas Lighting, Ltd.

Prototype

A writing surface 4ft by 3ft was selected and the diffuser ultimately chosen was manufactured from ¼in plate glass with one side satin acid embossed and the other white acid obscured. By experiment it was found that the white acid obscured face provided the best writing surface as the fine grain created a slight key for the various writing materials which were tried. Charcoal proved to be the most suitable both for writing and visual accuracy and the diffuser surface could be cleaned with a damp cloth.

The cabinet of the prototype board (Fig. 1) is made of wood and measures 4ft 6in by 4ft 3in by 1ft. The top 9in houses the control gear, allowing adequate ventilation for any heat generated. The glass diffuser is fastened into a removable timber frame and held in position by screw fittings. The interior of the lamp compartment is finished in a matt white paint and the six 4ft fluorescent tubes are fixed to the back by Terry clips. Atlas white tubes are used with a colour temperature of 3,500°K. These have the highest lumen output of any white tubes and a reasonably balanced colour range in the spectral energy distribution wavelength. Apart from the question of heat, it would have been impossible to obtain an even illumination on the diffuser with tungsten lamps.

Brightness Tests

The maximum brightness recorded for the glass diffuser surface was 1,072 foot-lamberts. The fluorescent tubes are spaced in relation to the glass diffuser to achieve evenness of flashing on the diffuser surface.

All the control gear in the cabinet is readily accessible for maintenance and is connected to an Atlas electron dimmer Type XR1/1600 hand control unit (Fig. 2) which can be placed in a suitable position adjacent to the board. This operates on 230 V single-phase supply and comprises two thyratron valves connected in anti-parallel and controlled by means of a resistor-capacitor phase-shift circuit. By this means it is possible to vary the light output of

* Senior Commercial Engineer, Atlas Lighting, Ltd.

the tubes from zero through any stage of intensity to full light output and to hold any chosen level of light for an indefinite period. With this particular system of fluorescent dimming the energy consumed is proportional to the amount of light emitted. When the tube is on full-check the electricity consumption will be of the order of 14 W per tube, which is all that is required to keep the cathodes at correct emitting temperature to ensure immediate operation for whatever light intensity is required. If preferred the control knob could be incorporated in the side of the cabinet and connected with the dimmer unit by low-voltage wiring.

For writing sentences a board spanning an entire wall would be needed and this could be achieved in a similar manner to the prototype using 5ft tubes which, if necessary, could be overlapped to avoid a difference in surface brightness. Alternatively, three or four self-contained boards could be placed in a continuous run, each board having its own separate dimmer control, so that the class could be divided into three or four sections comprising children who required different levels of light.

The children's sight is normally tested by means of Snellen's chart, which has on it script in various sizes numbered 5, 6, 9, 12, 18, 24, 36 and 60. A child's vision is expressed in the distance in metres from the sight testing chart, i.e., 6-5, 6-24, and so on, and a child with 5-60 vision would for all practical purposes be blind. The sight, of course, can be helped by means of glasses.

The most successful writing medium has been found to be vine charcoal which enables the teacher to write characters of the order of $\frac{3}{8}$in thick. By varying the light intensity the child is enabled to see by means of contrast, black letters on a white background. So far the children of all ages in this school (they vary from five to 16) have been divided into three groups with regard to illumination values, and there is no doubt that this form of blackboard illumination does enable these children to scan the board quite quickly and, indeed, one child with a 5-60 vision is clearly able to distinguish shapes, squares and triangles, etc., which he was quite unable to do on an ordinary blackboard. It is, of course, necessary to have complete control of the lighting intensity as this must be varied according to the daylight conditions.

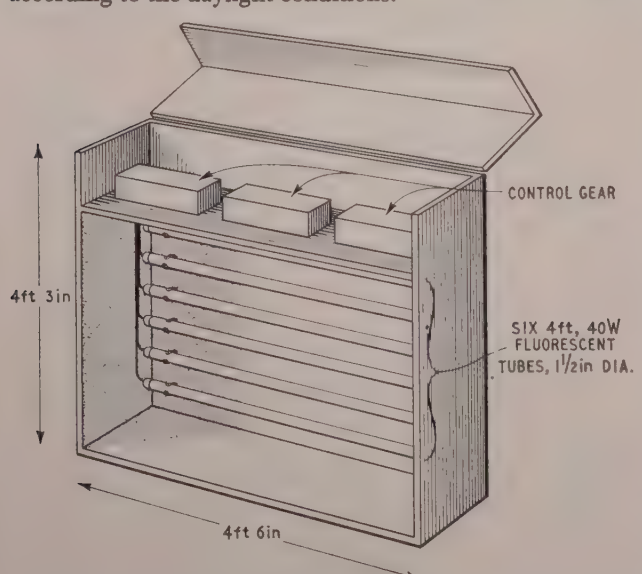


Fig. 1.—Construction of the blackboard with the glass screen removed

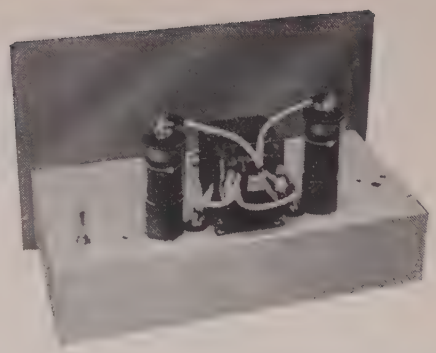


Fig. 2.—Atlas electronic dimmer control (shown opposite alongside the board) with case removed to show thyratron valves

This illuminated board can also be used for geography lessons by placing in front of the diffuser screen a map which has been painted on a fine open mesh. The contrast which is then caused by the various colours in which the map is painted enables the children to trace outlines with their hands. This type of geography instruction has been developed in a general way by the headmaster, but the system of blackboard lighting now envisaged gives 100 per cent improvement on the original idea.

The children have been most co-operative and among those who have benefited greatly from this prototype are those who suffer from:—

1. Retrolenthal fibroplasia with monocular vision—this disability is caused by placing premature babies in oxygen tents with too high an oxygen rate. This has the effect of destroying parts of the retina.

2. Bilateral trauma—this is the effect of an accident to both eyes. In one boy's case the sight of one eye has been completely destroyed and the other seriously damaged, the eye having a bulge behind the retina. This particular boy benefited most, especially in being able to distinguish shapes.

Other children who should benefit from this type of blackboard are those suffering from myopia—which means the eye is the wrong shape and, therefore, the image is out of focus, and glaucoma—enlargement of the eye caused through an increase in pressure which narrows the field of vision.

All the children at the school have individual tuition to suit their varying disabilities, and they also use reading books which have much larger and blacker type than that used in a normal school.

When the children leave school at the age of 16 they are able to take up a useful occupation; some act as telephonists, typists or laboratory assistants, some have gone on to grammar schools and one boy with a vision of 6-36 is working as a clerk in the Stock Exchange. The intelligence record of the children at this school is very good.

Dr. Ranby, of Atlas Lighting, Ltd., is now preparing an electroluminescent desk top which will have its own lighting intensity control. When this is available it will be supplied to the headmaster so that experiments can be carried out by individual children. By placing the writing paper on an illuminated surface a child is helped in its task of seeing print.

The work described in this article has been a team effort and the writer wishes to express his appreciation to Mr. Joseph Rawlinson, C.B.E., chief engineer of the L.C.C., to the headmaster, Mr. H. Summers, and his staff, and to Mr. H. Lambe, of the chief engineer's department, L.C.C.

Trends in LIGHT SOURCES

By H. L. PRIVETT, B.Sc.(Eng.)*

During the past 60 years the main developments in electric lighting have been aimed towards improvement of conversion efficiency. The point has now been reached where increasing attention can be given to other aspects of light production such as colour rendering, optical control, and more compact light sources of both incandescent and fluorescent types

MUCH of the progress in the development of lighting techniques exemplified by the new I.E.S. Code[1] has been made possible by advances in the economy with which electric light is produced. This greater economy has been achieved as a result of:—

(a) Improvements in the conversion of electric power to light through basic research and development by the electric lamp industry in this country and abroad.

(b) The allied efforts of the whole electrical industry in raising the efficiency at which electric power is obtained from combustion.

(c) Improved optical control of light sources.

(d) The development of mass production methods, including quality control, for lamps and their components.

Conversion Efficiency

The initial excitement and attraction of electric lighting was associated with its then almost magical convenience, coolness and freedom from obnoxious fumes, rather than the fundamental efficiency at which light was obtained.

Just how inefficiently light had been produced before the present century is emphasised by Fig. 1, which illustrates pictorially the progress made in producing artificial light in the twentieth century compared with that of previous ages. The efficiency has been calculated in terms of lumens per watt.[2]

By the 1920's the incandescent filament lamp had been so improved that it had an energy conversion efficiency of some 7 to 10 per cent, i.e., the power radiated in the visible region expressed as a percentage of the power input. Even with a generation efficiency of electric power of about 20 per cent, the overall efficiency of light production of the incandescent lamp was still similar to that of competing oil and gas lamps. Through the research and development on new types of glasses, tungsten metallurgy, and methods of construction that have led to the modern electric discharge and fluorescent lamps, the conversion efficiency of lamps of these types has been raised to nearly 25 per cent. If we take into account also the improved

* Application Development Department, A.E.I. Lamp & Lighting Co., Ltd.

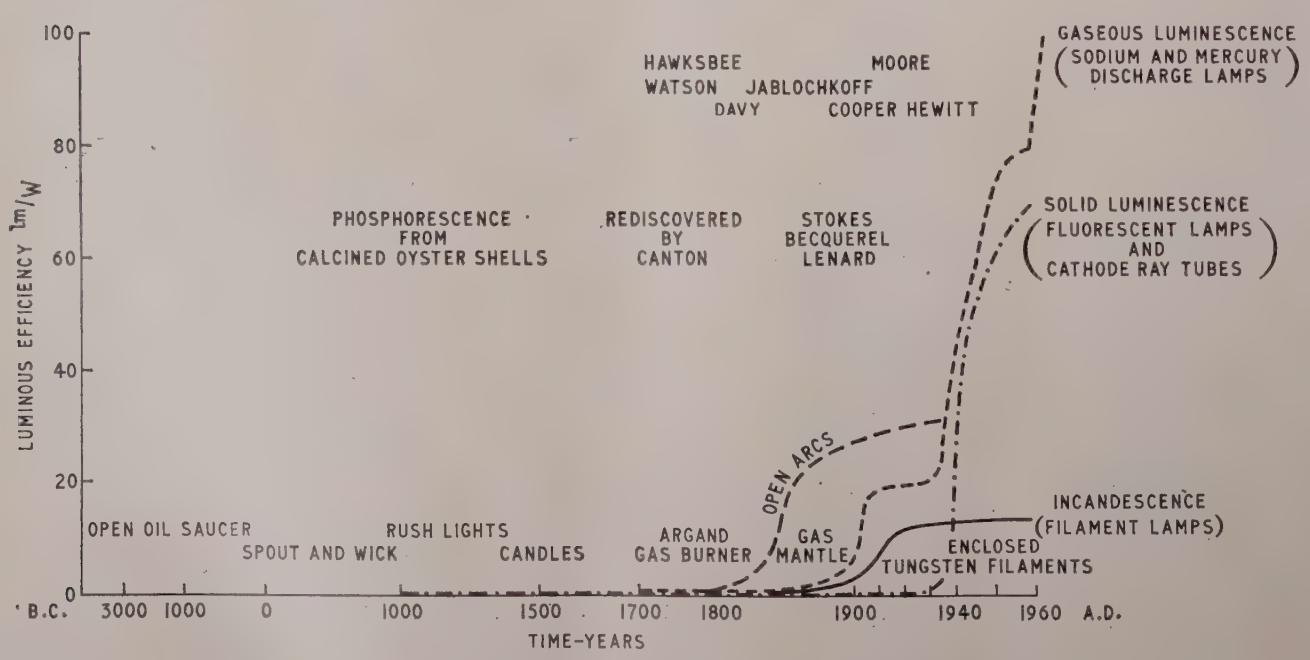


Fig. 1.—The rising efficiency of artificial light sources with the dates of major developments

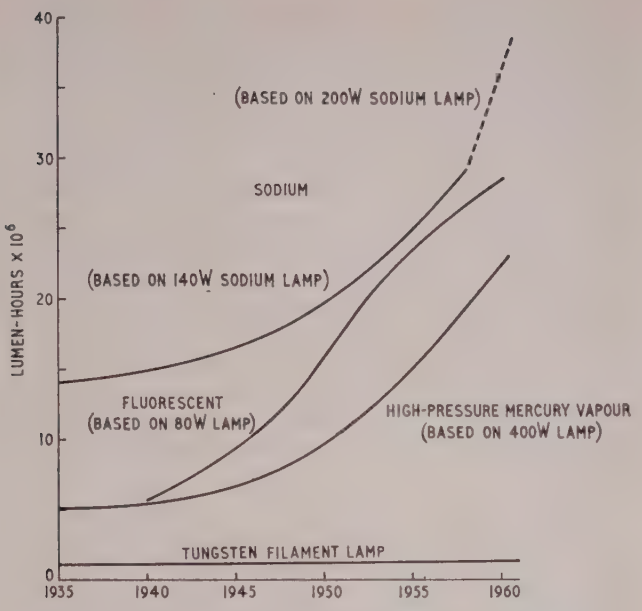


Fig. 2.—The gain in the product (light output x life) over the past 20 to 30 years is shown for various types of electric light sources

generating efficiency of a modern power station, say, 30-35 per cent, then the overall conversion of the combustion of fuel into light using electric discharge or fluorescent lamps is effected with about four times the efficiency of the light produced by the direct burning of the gas or oil. Furthermore, this increase in efficiency of light production has been obtained without any decrease in the life of the source.

Although gradual improvements continue to be made in tungsten filament lamps, higher lamp efficiencies can at present be obtained only by raising the filament temperature which involves some sacrifice of lamp life. Discharge lamps do not suffer from this disadvantage and since their commercial introduction before the war they have made steady progress as new methods and techniques have been developed.

Some idea of what has been achieved may be obtained from Fig. 2, which illustrates the lumen-hours for hypothetical 100 W lamps of various types, plotted against the date of production. On this basis the light output of mercury and sodium vapour lamps has increased three to four times since 1935, whilst that of fluorescent lamps has increased some five-fold.

The trend to increased efficiency of light sources, combined with improved components and methods of production, has resulted in a greatly reduced cost of light. This is shown in Fig. 3 which allows for changes in the purchasing power of the pound. It can be seen that we are now getting some 50 times the amount of light from tungsten filament lamps for a given expenditure obtained in 1907. An even greater increase—some 200 times—has occurred if we take fluorescent lamps into consideration.[3]

There can be few commodities that can show such a reduction in cost over the same period, and the stage has now been reached where the utilisation of artificial lighting can compete with the cost of making natural daylight available in buildings. Because artificial light has become so cheap, further increase in the efficiency of lamps, though of course still desirable, need not now be the aim of lamp engineers to the exclusion of other desirable objectives such as, for instance, the production of light sources which have good colour-rendering properties. The design of economic sources that enable the lighting engineer to produce glare-free installations can also now be accomplished without undue losses. The lighting engineer is, in fact, now much less restricted by the limitations of his main tool—the artificial light source.

Optical Control

With the advent of cheap artificial light, the recommended values of illumination necessary to perform given tasks satisfactorily have been increased. These increased levels of illumination can obviously be achieved in two ways—by increasing the number of light sources and fittings or by increasing the light output of each source. Both methods have their problems. Increasing the number of sources or fittings can result in what has been described as "space pollution"[4] and the alternative solution demands new types of lamps and introduces possible problems of glare.

Most forms of light source—tungsten filament, mercury vapour and fluorescent (though not xenon or sodium vapour)—can now be obtained in bulb shapes which incorporate some form of internal reflector. In the case of tungsten lamps this reflector is metallic and being on the internal surface of the lamp bulb obviates the necessity

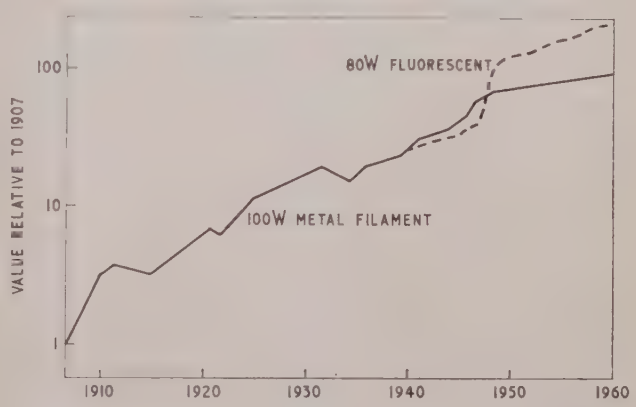


Fig. 3.—The amount of life available for a given cost, taking into account the changes in the purchasing power of the pound since 1907

for cleaning—a great advantage in installations where access is difficult and maintenance costly.

Where strict optical control is desired, the trend is towards the greater use of sealed-beam types of tungsten lamp. These lamps, an example of which is shown in Fig. 4, have found applications in the car industry where sealed-beam headlamps are gradually replacing the ordinary type of lamp. Besides giving good optical control the larger bulb is less prone to blackening and the reflector is protected against deterioration from the atmosphere. Sealed-beam lamps of higher wattages are used for aircraft landing lamps and also find application in the visual glide-path indicator developed by the Royal Aircraft Establishment, Farnborough. New uses and forms of these sealed-beam lamps will doubtless occur in the future.

Tubular fluorescent lamps fitted with internal titanium-dioxide reflectors have been well known for some years for use in shop window lighting, and internal reflector lamps—modifications of the high-pressure mercury-vapour lamps, plain or fluorescent—have been developed for use in



Fig. 4.—In these sealed-beam headlamps the beam is closely controlled by an internal reflector which is protected from atmospheric corrosion. The large bulb is less prone to blackening than in the smaller non-sealed-beam type of lamp

industrial high bay lighting units. These high-pressure mercury-vapour reflector lamps will also find increasing uses as a variety of sizes are developed.

Compact Sources

Where external control of the light from a lamp is necessary, the physical size of the light source plays a great part in the design of the luminaire in which it is to be used, and the lamp engineer is often asked for a source of small size that will facilitate optical control. Over the past few years there has been a steady reduction in the physical size of light sources for a given wattage.

A well-known example is the mushroom shaped tungsten filament lamp, the high performance of which has been made possible by improved methods of lamp processing during production, and the use of internal white diffusion coatings to reduce glare. Fig. 5 shows the reduction in size of the 60 W tungsten filament lamp over the past few years.

With the development of improved phosphors capable of operating at higher temperatures it has also been possible to reduce the size of the bulbs of high-pressure mercury-vapour fluorescent lamps and to change the envelope from the conventional bulb to an elliptical shape, as shown in Fig. 6.

With the exception of those bent round to form a circular lamp, low-pressure fluorescent lamps have taken the form of straight tubes varying in length from 6in to 8ft. Though this shape has been an advantage in some installations, it has tended to restrict the domestic use of these lamps, except perhaps in kitchens. A compact form of the lamp has, however, been developed in America,[5] and an 80 W fluorescent lamp measuring approximately 1ft by 1ft by 1½in deep has now become available. One example of this type of lamp is shown in Fig. 7. Similar in appearance to a square glass plate, it can more readily be used as a domestic source and also be incorporated into ceiling modules. The manufacturing techniques used in this lamp may be applied to other sizes and the future fluorescent lamp, with or without an internal reflector, may as a result become more compact.

A new substance, produced in America, can replace the glass or quartz envelopes of compact discharge lamps.[6] This is an alumina ceramic called "Lucalox" which can withstand attack from alkali metallic vapours. Experimental lamps using this type of envelope—about 2 to 3in long and ⅜in in diameter—have been made using caesium as a medium for the discharge. If these developments are successful a new range of lamps having good colour-rendering properties and small size may become available to the lighting engineer.

Tubular Lamps

Perhaps the greatest reduction in bulb volume has taken place in the 1 kW tubular infra-red lamp. This consists of a tungsten filament running at 2,400°K, supported inside a quartz tube. The lamp measures approximately 14in overall (according to the type of cap) by ⅜in diameter —a vast reduction in bulb volume when compared with a lamp of similar rating fitted with the conventional bulb-shaped glass envelope. Because of its narrow diameter, the lamp can be easily incorporated into simple optical systems which give a fan-shaped beam. This lamp (Fig. 8) and its application have been fully described by Coaton and Phillipson.[7]

If similar lamps are to be used for lighting purposes, the filament temperature must be raised to give a light that is not excessively yellow. This tends to accelerate blackening of the quartz tube by evaporated tungsten from the filament. Research has been going on in this country



Fig. 5.—The tendency towards the reduction of bulb size is illustrated by these 60 W tungsten filament lamps. On the left is a lamp produced before 1952, the centre lamp is its modern counterpart, and on the right is the new mushroom lamp

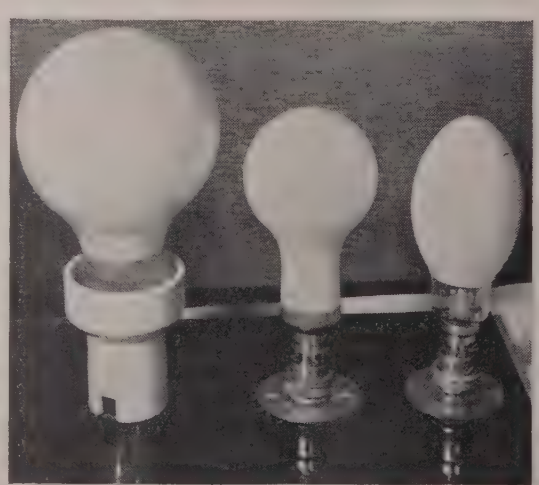


Fig. 6.—In 1938 before modern phosphors capable of withstanding high temperatures were developed, the bulb size of MBF/U lamps was necessarily large. Improved phosphors allowed a reduction in bulb size to that of the centre lamp in 1953 and an improved shape introduced this year is shown on the right

and abroad to prevent this by the introduction of iodine into the envelope. This has the effect of returning the evaporated tungsten to the filament again by a cyclic chemical action. We may therefore see small tubular filament lamps of comparatively high wattage being used as light sources as this process is developed to a successful conclusion.

The tendency towards a tubular form has already started with sodium vapour lamps and a 3ft by 1½in diameter lamp (Fig. 9) has been marketed for some time. The lamp arc tube has a number of troughs or indentations moulded along its length, giving it a non-circular cross-section without excessive loss of mechanical strength. The increased arc tube surface area and the non-circular cross-section increase the amount of light emitted by the lamp, thereby raising its efficiency. The indentations also help to retain the sodium in place along the length of the arc tube. This lamp, with its large length/diameter ratio and an efficiency of over 100 lm/W, has proved a useful tool for the street lighting engineer[8] and here again one can visualise this type of lamp being produced in other wattages and lengths if required.

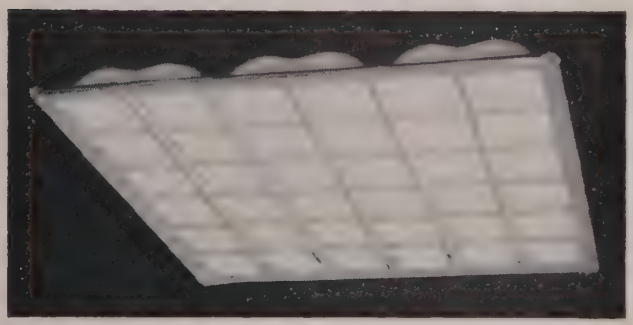


Fig. 7.—This American fluorescent panel lamp (1 ft square) is an example of the way in which lamp engineers have succeeded in manufacturing a compact low pressure fluorescent lamp

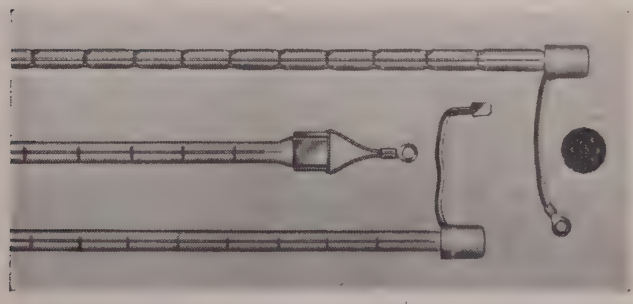


Fig. 8.—Mazda infra-red quartz tubular lamps are available in a number of wattages with a variety of end caps. This is illustrated by the part view of three lamps and a threepenny piece above. The top lamp is dimpled to locate the filament supports for vertical burning

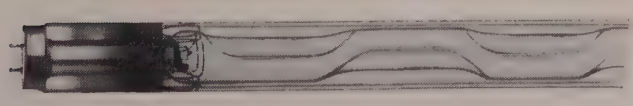


Fig. 9.—The end view of a modern 500 W linear sodium lamp showing the inner arc tube with its indentations to provide a large surface area for the discharge and to "anchor" the sodium in place. The arc tube is integral with the outer jacket

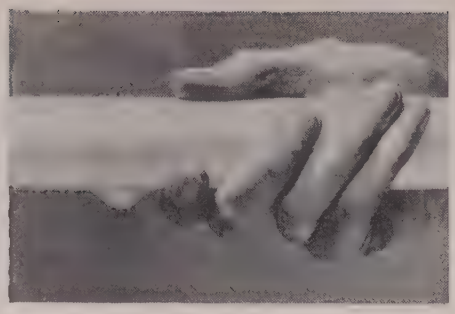


Fig. 10.—One form of fluorescent lamp capable of running at high current densities. The vapour pressure of the mercury filling is controlled by the temperature of the small protuberance at the centre of the lamp (Philips Electrical, Ltd.)

A higher wattage for a given size of tubular lamp enables a higher light output to be obtained from existing lighting points.

Both in America and on the Continent the most popular fluorescent tube has been the 40 W, 4ft by 1½in diameter. This has only approximately half the wattage per foot run of the British 5ft 80 W lamp, which has been the most popular size in this country. Attempts have been made abroad to up-rate the 40 W lamp to approximately 80 W and lamps of this type have been produced in various forms. These lamps are designed so that one part of their envelope is kept at a temperature of about 40°C to control the vapour pressure of the mercury filling and avoid loss of efficiency.[9] Here then is a further trend which, though more applicable to countries hitherto favouring the 4ft 40 W lamps, may well find echoes in this country. One manufacturer has already marketed a 5ft lamp of this type up-rated to 125 W (Fig. 10).

Colour Rendering

Over the past few years the need for accurately rendering the colours of substances and articles has become more important. Before the advent of fluorescent lamps, artificial electric light was obtained in the majority of cases from tungsten filament lamps. The colour of the light emitted from the filament was more or less fixed owing to the fact that lamp life and efficiency are very dependent upon filament temperature, and colour changes were therefore obtained by using coloured bulbs or by placing filters round the lamp. These methods were obviously wasteful. The so-called "daylight blue" tungsten lamp used in shops had an efficiency of only about 4 lm/W, that is, some 70 per cent of the light from the filament was absorbed by the blue filter on the lamp bulb.

Attempts to correct the colour of the light from high-pressure mercury-vapour lamps, introduced in the 1930's, were also only partially successful. Here a phosphor on the lamp bulb added orange-red to the output of the lamp when excited by the long-wave ultra-violet radiation from the mercury discharge. The difficulty of producing phosphors capable of giving enough colour correction and able to withstand the bulb temperature made this method only partially successful. The advent of the low-pressure tubular fluorescent lamp, in which the main light from the source is, in fact, produced by the fluorescent coating on the inside surface of the tube, opened up fresh hopes of obtaining a lamp capable of giving good colour

rendering. The original fluorescent lamps obtained their "white" light output from a mixture of three phosphors giving red, blue and yellow light, and, by adjusting the proportions of these, various lamp colours such as "daylight" and "warm white" were easily obtained. The discovery of halophosphate phosphors by which similar colours to those mentioned above could be obtained from single powders greatly eased the problems of manufacture and colour maintenance during life.[10]

However, with the increasing use of fluorescent lamps in everyday life, the public and shopkeepers are becoming increasingly critical of colour rendering by these sources. To meet this demand for better colour rendering the wheel has rotated full cycle and fluorescent lamps for good colour rendering now generally contain a mixture of more than one phosphor. Lamps of this type can be made giving an output such that colours seen under them have the same appearance as when viewed out of doors on a sunny day.[11]

"Sunlight" can now in fact be brought indoors by modern fluorescent lighting, and lamps can be used to supplement natural daylight in buildings with an effectiveness not hitherto realised. With higher efficiencies, lamps can compete with the provision of natural daylight or be used to permanently supplement it when it is inadequate. The provision of natural daylight is not without its problems, for windows let in solar radiation during summer which may have to be combated by air conditioning, and can let out heat during winter, thus calling for increased space heating which would not otherwise be necessary. Natural daylight is therefore not free, and windows can occupy valuable wall space which could be used for other purposes. Problems of glare can arise from windows under certain conditions and this can be alleviated or overcome by permanent supplementary lighting. The tubular fluorescent lamp can be used in glare-free fittings and lends itself to optical control. Some windows are desirable to maintain contact with the external world and to allow the eyes of the occupants to relax, but any deficiency in the natural daylight provided can well be made up by the use of fluorescent lamps having a colour appearance and colour-rendering properties that will mix with and supplement natural daylight.

In industry where colour matching and fading tests are important the use of the xenon lamp is increasing. This has a spectral distribution close to that of daylight and provides an excellent source for tasks where colours have to be matched or compared. In high power ratings it can also be used for fading tests which were hitherto dependent on the vagaries of the weather. Its very small source size makes it admirable for the optical systems of film projectors and it is being used to an increasing extent for the projection of colour films.

To summarise, it may be said that the present high efficiency of electric light sources is such that they can be economically employed for permanent supplementary lighting. There is a tendency towards lamps of smaller physical size that can be incorporated into luminaires to give glare-free installations, as recommended by the new I.E.S. Code. Increased emphasis is also being placed on colour-rendering properties of lamps and with modern phosphors this can be achieved with high values of luminous efficiency.

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[10] H. G. Jenkins, A. H. McKeagh and P. W. Ranby. *Journ. Electrochemical Soc.*, 1949, 96, No. 1.
[11] H. R. Ruff and F. E. Large. "Fluorescent Lamp Colour Developments." *Elect. Review*, 9th September, 1960.

SERVICE CONTRACTS FOR DOMESTIC APPLIANCES

THE growth of independent organisations offering service contracts for domestic appliances was forecast by Mr. Nicholas Stacey, economic and marketing adviser to the General Electric Co., Ltd., in a paper to the Economic Section of the British Association.

Many of the post-war innovations in retailing—with the exception of department stores—had striven to reduce the service element in retailing, he said. For radio and television sets and many domestic appliances, "cash and carry" might be a cheap solution for the price-conscious customer but it was not the whole answer for the enjoyable possession of the goods. To help radio and television manufacturers and dealers, "contract maintenance services" had been established. They performed a useful task in offering the retailer a call on skills which he did not possess, or national repair coverage for a manufacturer who could not support depots, staff and stocks in many parts of the country.

"The next stage," Mr. Stacey said, "is to approach the 13 to 14 million owners of domestic equipment and offer a service contract to them direct on a monthly or annual fee basis. The time must surely come when the entire range of consumer durable equipment in the home will be checked and tested periodically, and repaired and maintained as required at a reasonable annual charge." Another service element in the distributive chain would then be relinquished by some retailers and manufacturers to a novel type of organisation which specialised in the provision of a certain type of service.

Non-Destructive Testing

THE Measurement and Control Section of the Institution of Electrical Engineers, in association with the British National Committee on Non-Destructive Testing, is arranging a conference on Non-Destructive Testing in Electrical Engineering. The theme of the conference will be "How best may the electrical engineer test the quality and endurance of his materials and structures?" The conference will be held at the Institution from Wednesday, 8th November, to Friday, 10th November.

VIEWS on the NEWS

By "REFLECTOR"

A HUNDRED years have passed since trams were introduced to London, although after a year's running they were abandoned and were not seen again until 1870. These were horse-drawn vehicles, of course; electric trams appeared in London in 1898. By 1933 there were fourteen local authority and three company systems operating in the London area; they were then all taken over by the London Passenger Transport Board. A good conspectus of London tramway history was arranged recently at the Bishopsgate Institute, London, by the Tramway and Light Railway Society on the occasion of the tramways' centenary. By means of a large number of models, some in operation, and a comprehensive collection of photographs, supplemented by many relics—such as destination indicators, street signs, tickets, name-plates, trolley-heads, etc.—the past was vividly recalled; one could almost hear again the clash and rattle of the cars which were for so long a dominant component of London's traffic orchestra. Alas! the London tramways never lived to celebrate their own centenary and now their more refined sisters, the trolley-buses, are also departing.

* * *

"Sub-Area Managers: Should They be Non-Negotiable?" asks a heading in the current issue of "A.M.E.E. News," the bulletin of the Association of Managerial Electrical Executive. This, I find, is not a move to place these managers in the same class as certain cheques; it relates to the electricity supply industry's machinery for determining salaries and conditions. Having made this clear, the note goes on to answer the question in the negative. The removal of the managers from the ambit of the negotiating machinery, it is said, would not be in their best interests. It would concede to the Electricity Boards the right to appoint future sub-area managers at "sub-standard" salaries and would have "disruptive and adverse" effects upon other managerial grades. "A.M.E.E. News" says that the majority of sub-area managers canvassed were opposed to "non-negotiability" while the majority of Area Board chairmen were in favour of it.

* * *

I believe that I have heard of the experimental introduction of the "Help Yourself" system at some Electricity Board showrooms. It was certainly introduced at the Blackpool premises of the North Western Board recently when a woman visitor whipped out a large sheet of brown paper, wrapped up a cooker and walked out with it. An assistant, realising that she had not paid for the cooker, ran after her; she dropped the cooker and fled. As the cooker weighed about half a hundredweight the description of the thief by the daily Press as "a frail old lady" seems a little strange.

* * *

Electron, the journal of the Electrical Trades Union, although under new management is still vehemently political. It is not all politics, however, as a note in the August issue shows:—

> "*Women's Page.*—We regret the mix-up over the knitting pattern and the picture shown in the June issue, but we will try to straighten this out in next month's issue."

The E.T.U., of course, has some other mix-ups to straighten out.

* * *

It is pleasing to learn from the *Northern Despatch* (Darlington) that a road has been named after Charles H. Merz in recognition of his achievements in the realms of electricity supply and traction. But I hope that the local authority has spelt his name correctly, as the newspaper did not.

* * *

Fifty years ago the *Electrical Review* (8th September, 1911) published an article on "The Office as a Workshop" in which the following passage appeared

> "Many firms who possess the most up-to-date workshops are still content with office buildings, the many defects of which are not by any means conducive to economy and efficiency, and, in such cases, one is tempted to suggest that the manager who has so successfully applied his knowledge of the conditions favourable to maximum production on the workman's part, should now turn his attention to the amelioration of the conditions under which the clerk and draughtsman work. He will find in many cases that the lighting is defective either in quantity or direction, and consequently at the end of the day many of the men are suffering more or less from headache due to eye strain."

It is a measure of the small amount of betterment since then that the Government is having to step in to enforce improved conditions. The subject is one which is dealt with in an article in this issue.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication
Responsibility cannot be accepted for the opinions expressed by correspondents.

Group Motor Control Boards

PLEASE accept my apologies for the error in my letter published in the *Electrical Review* of 14th July in respect of load breaking, fault making switches. Mr. Lythall was, of course, quite correct. However, Mr. Lythall referred me back to Figs. 6(d) and 6(a) in his article in the 30th June issue of *Electrical Review*. I would comment further as follows:—

My main point was that I could not see any application whereby the "P" fuse in Fig. 6(a) or the "P" air circuit-breaker in Fig. 6(b) could be justified. In fact they should be avoided. I believe I am correct in saying that the article is advocating more use of the h.r.c. fuse at the main l.v. board positions and not at the incoming supply position on the group motor control board, because the main l.v. board fully covers the protection requirements.

In my opinion Figs. 6(c) and 6(d) cover all requirements except that fuse "P" in Fig. 6(d) may need to be an a.c.b. for certain applications. In these examples the need to replace the main fuse at the group motor control board disappears and can be replaced in safety at the main l.v. board.

However, I do feel that the question of the application of "on-load" or "off-load" isolation comes within the scope of the article, "Group Motor Control Boards," as these form an integral part of the board. Taking Fig. 6(c) as an example, what would Mr. Lythall normally recommend, "on-load" or "off-load" isolation? In his experience, has he found any cases where an "off-load" isolator had been fitted, but operated in an emergency, by a layman, "on-load"; and which, as far as he is concerned, is the "main switch"? I would appreciate Mr. Lythall's views on the desirability of fitting "off-load" isolators at all because, if the reason for fitting them is a question of maintenance only, then the switch or a.c.b. at the main l.v. board could be locked-off and the same result achieved. As a question of safety at all times, it would appear to be "on-load" switches versus an emergency trip button and cabling combined with h.r.c. fuses or a.c.b.'s respectively, but at the main l.v. board; and which is the most economical?

A further point which I would add is that, whilst the "extremely inverse time" relays are available, one should not create conditions whereby they have to be used, when in fact they could be avoided.

Barnehurst, Kent. M. A. C. HOLDER, A.M.I.E.E.

Mr. Lythall has seen Mr. Holder's letter and replies as follows:—

CONSIDERING first Mr. Holder's point in relation to Fig. 6, I agree with him that (c) and (d) cover all requirements and are the preferred arrangements. In practice, however, I have encountered many examples as at (a) or (b) and it was for this reason that the four possibilities were included. As between (c) and (d), my preference would be (d) when the fuses are so placed as to give protection to the cable between the main and motor control switchboards, a view which would appear to be supported by the extracts quoted in the postcript to the article from Mr. G. S. Buckingham's I.E.E. paper on "Short-time Ratings for Cables."*

Mr. Holder is correct in believing that the main purpose of the article was to advocate the use of h.r.c. fuses as protective devices against busbar faults on group motor control boards. Fig. 6 was produced in furtherance of the arguments offered to show where fuses and/or other protective devices might be placed. No attempt was intended to recommend one or other arrangement and in fact even though the scheme at (a) leads to other problems, it would still meet the purpose of the article.

As to his second point concerning "on-load" or "off-load" isolating switches and his claim that in an article entitled "Group Motor Control Boards" it is right to discuss this problem, may I point out that the title used was not that in my original script. Here it read "Fault Current Limitation at Group Motor Control Boards" and this rather long title was shortened editorially to that which appeared. The fact that the article dealt with fault current limitation (and I emphasise this) was made quite clear, however, in the editorial note subsidiary to the title. Nevertheless, I will try to answer the questions he poses as briefly as possible.

(1) Whether the isolator at (c) Fig. 6 should be "on" or "off" load depends to some extent on the current rating. Up to say 800 A "on-load" switches are readily available and, for example, one can use a fuse-switch design but replacing the fuse-links by solid copper links. At higher values, say up to 2,000 A, "on-load" switches are not such an economic proposition. My recommendation would be "on-load" if available and the user is prepared to pay. If "off-load" is used, then the engineer must ensure adequate instruction to his staff on its proper use. In my experience, many engineers prefer to have some means of isolation at the control board particularly if the circuit-breaker at the main switchboard is some distance away and most likely out of sight. Even an "off-load" isolator tends to give greater confidence to anyone working on the control board, even though the remote circuit-breaker may be locked off.

(2) Personally I do not know of any reported case where an "off-load" switch located as at (c) in Fig. 6 has been operated "on-load" but I have no doubt it may have occurred.

(3) I would regard the "P" circuit-breaker in Fig. 6(c) as the main switch.

(4) The question of desirability of "off-load" isolators at all is, I think, largely answered under (1) above.

(5) Many installations within my knowledge have provision for emergency tripping of a remote circuit-breaker by push button at the motor control board. Such emergency tripping, however, does not make it any safer to work on the control board as it may still be necessary to ensure

* *Proceedings* I.E.E., Part A, June, 1961.

(*Continued on page* 391)



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Here's lighting with a new look for stores and offices . . . a range of beautifully finished fittings combining the quality of 'New-Range' with a choice of three colours for the dished end-plates. The reeded opal plastic diffusers spring easily into position on the standard 'New-Range' chassis, and form a close dust-tight fit all round it. In 5ft. or 4ft. sizes, one or two lamp fittings with end-plates in red, primrose, or cerulean blue enamel; high power factor switch-start or snap-start control gear, and spring-loaded bi-pin lampholders.

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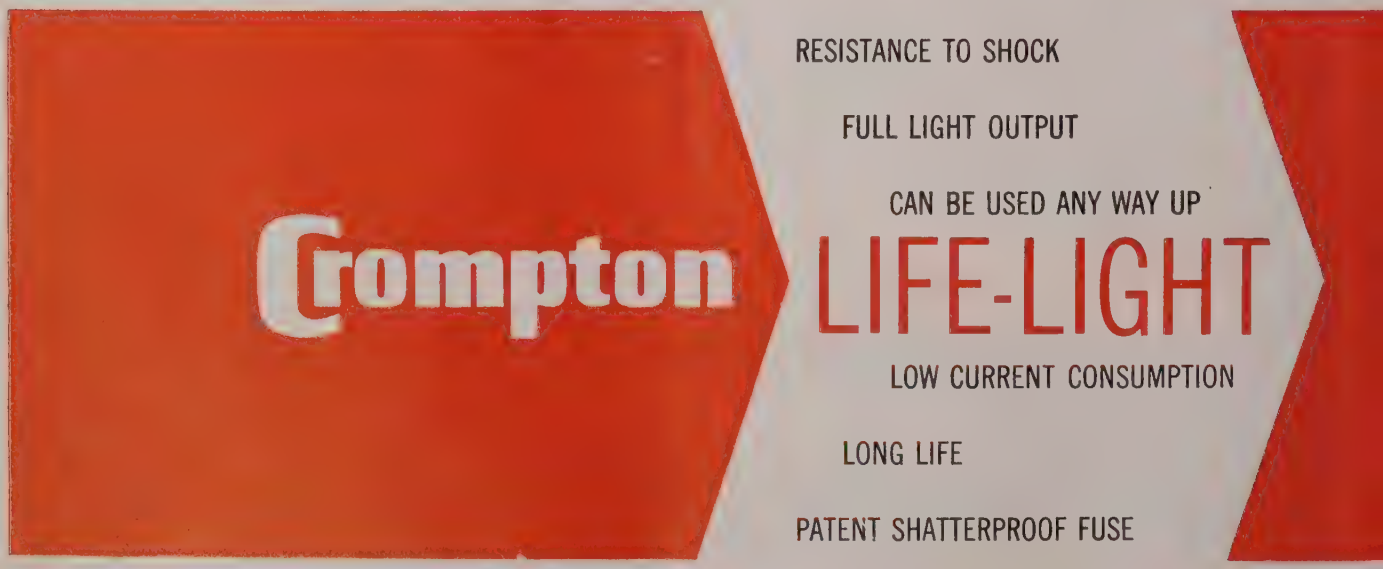
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STILL! no other lamp in the world has all its features

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A better kind of lamp The Crompton 'Life-light' is designed to have the best possible combination of light-output, life and strength—hence its name.



This is the story behind the lamp 'Life-light' is a single-coil lamp. Every test shows that a single-coil filament is far more robust than the coiled-coil one. The light output of the popular 100 watt single-coil lamp has been increased so that the difference from that of the coiled-coil type is only marginal. Hence, with single-coil lamps you gain robustness and reliability at the expense of a difference in light output that is unnoticeable.

We have therefore strengthened the single-coil lamp and made it tougher still; by improving the method of filament suspension, by increasing the pressure of the argon gas-filling—and by the most scrupulous cleansing of the inside of the lamp *immediately before* it is *sealed*. This is 'Life-light'.

Finally, Crompton 'Life-light' lamps are exclusively fitted with patented shatter-proof fuses which provide absolute safety against the possibility of a lamp bursting.

Of course we shall continue to make coiled-coil lamps for those who want them. But in our opinion the lamp that both you, the retailer, and we, the makers should sell, is 'Life-light'. Simply because no other lamp can give such a reliable service, nor promote such goodwill between manufacturer, trader, and user.

Explain to your customers, as we have explained to you, *why* 'Life-light' lamps are better—it will pay you handsomely in goodwill.

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And no other lamp has this kind of advertising

Last year, you remember, we did something entirely new in lamp advertising. We didn't use gimmicks or slogans but explained exactly *why* 'Life-light' was a better lamp. This campaign caused more comment than any lamp advertising for years and we are going on with the same theme because it is the kind of advertising that is cumulative, but we are doing far more of it. In all, these advertisements will be seen over 80 million times. So this year they will do even more to increase your sales.

To help you sell these lamps hard we are offering you this point of sale and display material.

Use it. See your customers buy the lamp that brightens your goodwill.

1 SHOWCARD. Carries on the 'Life-light' theme. Attractive and striking to look at and takes up very little space. Use on the counter to attract attention.

2 MOBILE. This well balanced and attractive mobile can be used in the window or in the shop.

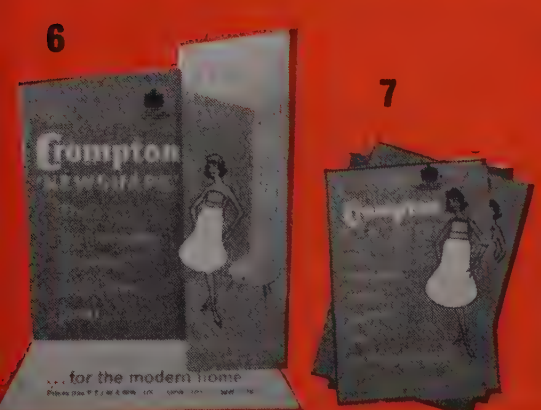
3 LEAFLETS. These leaflets are your best aid to selling 'Life-light'. They tell the customer exactly why 'Life-light' is a better lamp. They mean repeat buying so see that they are picked up.

4 LARGE DISPLAY. This forms the centre piece of a window display or alternatively can be used as a large showcard inside the shop. It tells the 'Life-light' story clearly and dramatically.

5 DISPENSER. Again this year we offer you this compact floor dispenser which is only 61 in. high and 13 in. square—a valuable sales aid for use inside your shop. (An early application is advisable).



ALSO THIS YEAR: Sales material for the CROMPTON 'NEWSHAPE' LAMP



6 SHOWCARD. Clean, bright and attractive: use it to draw attention to this very popular lamp.

7 LEAFLETS. Keep these near showcard, they are powerful selling aids.

Note. Crompton 'Newshape' has the same internal construction as 'Life-light': It is thus as much in advance of other lamps with this new bulb as 'Life-light' is in advance of other lamps of the ordinary shape.



If yours is "no ordinary" lighting problem

Well, we don't talk about "Lighting problems" ourselves, because a project is no longer a problem when you know the answer. But industrial lighting does often call for expert knowledge and experience, a particular knotty point may be similar to a job we tackled last week, or even if it is a new one the distillation of knowledge gained from experience of other challenges will enable us to advise you correctly.

Just a few fittings in the wide range of Simplex Lighting Equipment are shown here.

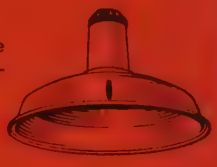
But we don't want just to sell you lighting fittings. We want to sell you light. The right amount of light in the right place at the right time. Therefore, we would be pleased to help or offer advice on any of your lighting problems — the type of fittings to use, the installation layout for best results etc. without obligation.

For immediate service there's a local Simplex branch near at hand — or write to Lighting Dept., at the head office address below.

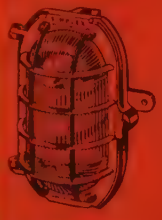
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Simplex Junior Reflector Flood. Designed and constructed specially for area floodlighting.



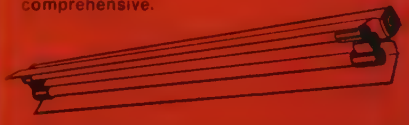
Simplex Dispersive Range of Weatherproof Reflectors for interior and exterior uses.



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The Simplex ACF (anti-corrosion fluorescent) Fittings are protected by a patented process that will not corrode even in the heaviest of industrial atmospheres.

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L.10

that the remote circuit-breaker cannot be reclosed. Nor can emergency tripping be applied if the remote device is a fuse-switch.

Finally, I would like to make it clear that all the foregoing are my personal views and that they do not necessarily represent those of the Belmos Co., Ltd., or the English Electric Co., Ltd., both of whose names were noted in the original article.

Dowsing for Buried Cables

I WAS interested to read the comments on dowsing for electric cables in your issues of 11th and 25th August. I have practised this method of locating cables since my apprenticeship days and have found it to be extremely accurate.

On a recent occasion I checked the accuracy of dowsing with an electronic detector and found that both methods are good when used out of doors. However, within the confines of a factory building the electronic detector was rendered useless by the proximity of structural steelwork and various items of electrical equipment. The "L" shaped tinned copper wires performed perfectly.

It has always surprised me that so few electrical engineers know of this method of cable detection. I have demonstrated dowsing to scores of people and have found that two out of three of them have been able to detect lost cables after a few minutes' practice. The method I use is similar to that described by Mr. Pulvermacher with the exception that the wires are held with the hands at hip level.

I have often thought that the reason this method of dowsing has never become popular is that there are very few places where an engineer can walk about like a gunman from a Western film pointing two slender copper wires directly in front of himself without being slightly embarrassed. Despite this, I think that the method should be taught to every engineer as part of his technical training.

Wolverhampton. F. W. BLOORE.

I HAVE read with interest the letter of Mr. F. H. Pulvermacher on the above subject in your issue of 25th August. Using "L" shaped copper rods in the same way, I have for some years found this method of great assistance in locating cables, water mains, and buried pipelines.

A cartoon published in the *Daily Mail* some years ago after an electrical engineer in the Cannock district had located some cables buried deep under a "shraff heap," depicted dustmen searching for scrap metal in the same way for purposes of gain.

The method can be operated successfully by 60 per cent of people who try it.

Uttoxeter, Staffs. W. KNIGHT.

EXPULSION OF THE E.T.U.

BY 7,320,000 votes to 735,000, the Trades Union Congress, at its meeting which opened at Portsmouth on Monday, approved the motion of the General Council recommending the expulsion of the Electrical Trades Union.

Mr. George Woodcock, general secretary of the T.U.C., after recapitulating the General Council's supplementary report to Congress, which gave the exchange of correspondence between the General Council and the E.T.U., emphasised that in this matter they were not concerned with Communism; the issue was the simple one of fraud.

The General Council, Mr. Woodcock said, was compelled to take this matter up because of the widespread accusations in the press that there had been ballot rigging in E.T.U. elections. These accusations had later become specific charges which, he said, had to be answered. For three years the E.T.U. had kept the General Council at arms length. Their tactics were evasion and delay. On the evidence available, Congress would have to decide the issue.

Replying in a forthright speech, which the General Council agreed should not be limited, the general president of the E.T.U., Mr. Frank Foulkes, said that whatever the vote might be, the E.T.U. would fight on as a trade union, striving at all times to improve the living standards of its members. He wanted unity of the trade unions, and the way to get that was not by expulsions of affiliated unions. He questioned the accuracy of many paragraphs in the General Council's supplementary report.

Mr. D. McGarvey, president of the Boilermakers' Society, of which Mr. Ted Hill is the general secretary, opposed the motion of the General Council. The instructions of the General Council to the E.T.U. would be in breach of E.T.U. rules, he said. No union, least of all his own Society, could be asked to do that. Expulsion would be a retrograde step.

The miners' delegation asked for a ten minute adjournment so that the various delegations could consider and weigh the statements of both sides. This was agreed, but the voting was never in doubt. After the result of the vote had been announced by Mr. Hill, the E.T.U. delegation were asked to withdraw from Congress and surrender their credentials.

At a Press conference Mr. Foulkes said that expulsion would make absolutely no practical difference to the E.T.U. He thought he had had a fair hearing.

Nuclear Anniversary Conference

A conference attended by more than 400 physicists was held in Manchester this week to commemorate the 50th anniversary of Lord Rutherford's discovery of the atomic nucleus. Although primarily concerned with current nuclear research problems, the conference programme included a session on Tuesday afternoon when a number of physicists recalled their early days with Rutherford in Manchester. The speakers during the week included Professor Niels Bohr, associated with the Rutherford-Bohr atom, Professor E. N. da C. Andrade, who worked in Rutherford's laboratory, and Sir James Chadwick, who discovered the neutron. This meeting is to be followed by an international conference at Harwell on the instruments of nuclear physics.



Holding rope attached to leading dead-end hauling tail being removed in front of south anchor tower

400 kV THAMES CROSSING

Conductor Stringing Completed Between West Thurrock and Northfleet

THE urgency of the extension of the 275 kV supergrid to South-East England was demonstrated by the power failure of 15th May last (see *Electrical Review*, 2nd June). The Central Electricity Generating Board recently announced that they were planning to erect a 400 kV transmission line across West Sussex, Hampshire and Dorset as a continuation of the proposed connection from Dungeness across Kent and East Sussex which has already been announced. No route has yet been decided upon for this double circuit line but wherever practicable a new line will be erected in substitution for existing grid lines. The line from Northfleet to Dungeness via Canterbury is now nearly completed and will be connected into the supergrid system by the Thames crossing between West Thurrock and Northfleet. It will also be connected into the French power network by the cross-Channel link between Boulogne and Lydd, Dungeness. It is expected that the Thames crossing, the Northfleet/Dungeness line and the cross-Channel link will be commissioned next November.

The West Thurrock-Northfleet crossing, which was described in some detail in the *Electrical Review* of 6th January, is designed for eventual 400 kV operation and employs the largest conductors ever used in a section of the supergrid. The six conductors of the double-circuit link and the earth wire each weigh 21½ tons and have an overall diameter of 2·214in. Their construction is shown in Fig. 1. It will be seen that a smooth outer surface has been obtained by wedge segmental aluminium wires with the object of reducing aerodynamic effects over the large spans.

The crossing contract was awarded to the B.I.C.C. Group early in 1959. Work on the foundations began early in 1959 and construction of the towers themselves began in August of that year. The total route length of the crossing is 7,700ft and the siting for the four towers is such that they are aligned to within ¼in. The crossing towers, each weighing 436 tons, are 630ft high and are constructed mainly in high tensile rolled steel sections, tapered in outline. They are 100ft wide at the base and 10ft wide at the top. The anchor towers are 145ft high and weigh 99 tons each. They are vertically faced on the front side, with a sloping face at the back (see Fig. 2).

Because of the nature of the crossing, and the heavy tensions, compression type dead-end clamps were fitted to the conductors in the factory. This required accurate

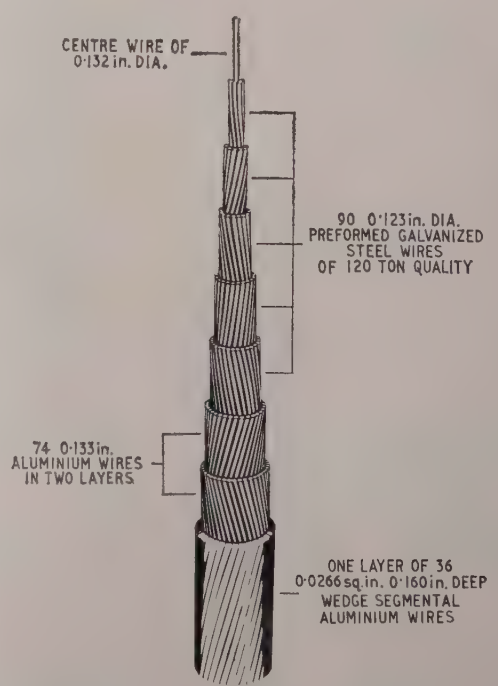


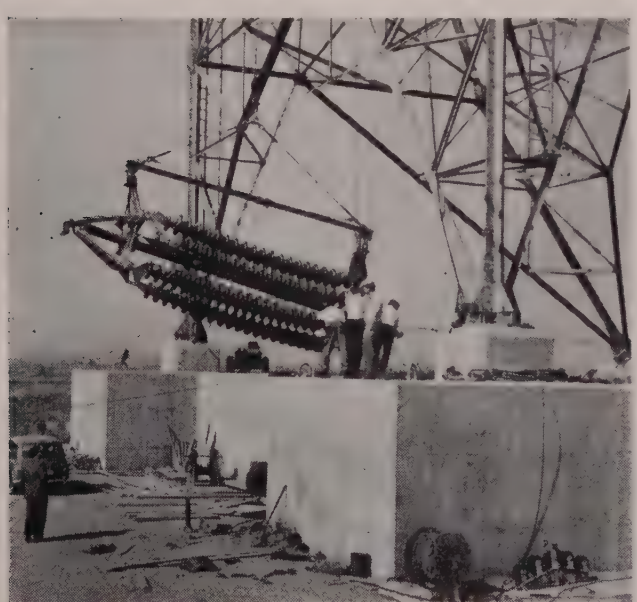
Fig. 1.—Construction of the conductor. The overall diameter is 2·214in

measurement of the conductor prior to fitting and a tolerance of ± 12in on the unstressed lengths of 7,754ft was necessary. The main problems associated with the stringing of the conductors were their length, weight, and a contract condition that they should not come into contact with either the ground or the river at any stage. For these reasons, a stringing system using track and haulage ropes was adopted.

By arrangement with the Port of London Authority, the river was closed for a brief period early in the operation to allow the track and haulage ropes, previously laid on the river bed by a barge, to be winched up between the two crossing towers. The haulage rope and track rope were " stitched " together by a set of trolleys running on the fixed track rope and pulled by the moving haulage rope. The conductors were then hauled by a further set of suspension trolleys, these trolleys being fed on at one end of the stitching trolleys, being removed at the



Leading conductor end approaching south crossing tower. The " bicycle," with one of its two 5ft diameter sheaves, can be seen in the centre



Tension insulator assembly slung ready for lifting into position on north anchor tower



Greasing armour rods and suspension saddle prior to connecting saddle to suspension insulator. Photograph taken on the " bicycle "

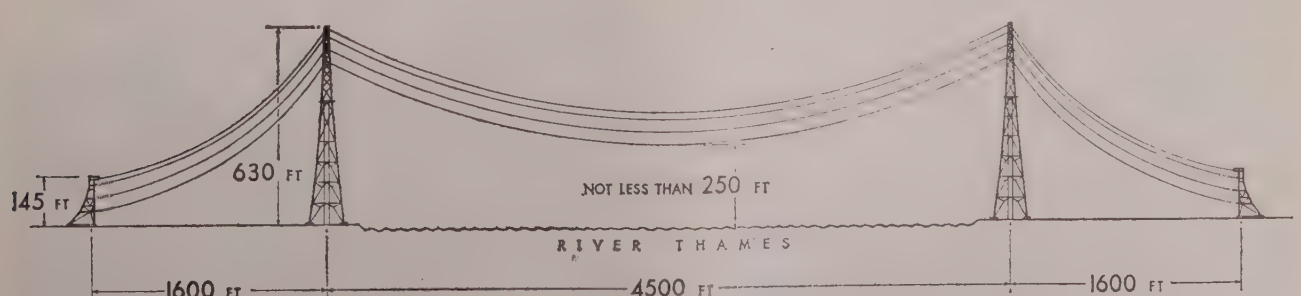


Fig. 2.—Side elevation of the towers and conductors



Leading end of first conductor length being lifted up and through the north anchor tower

other end. To carry the conductors through the crossing towers and to facilitate lowering them to their final position, a " bicycle " or conductor cradle with two 5ft diameter rubber-lined sheaves at 26ft centres was hung from the top of the crossing towers just below the track rope.

As the leading end of each conductor reached the far anchor tower, tension was applied at both ends to lift it clear of the suspenders. The conductor was then lowered, by means of the " bicycle " at the crossing towers and by tackles at the anchor towers, to its final position when sagged. Tension insulator assemblies each weighing $3\frac{1}{4}$ tons, with a length of $24\frac{1}{2}$ft and comprising eight strings of twenty $12\frac{3}{4}$in diameter porcelain units in parallel, were introduced and attached to the anchor towers. The correct sag was obtained by adjusting the distance between the end of the conductor and the anchor towers.

Twenty-two armour rods about 30ft long were fitted around each conductor at the point of suspension as a cushion, which was then placed in a saddle. The saddle was offered up to the crossing tower suspension insulator assembly by adjusting the position of the " bicycle." The saddle and insulator string were then connected by bolts, and the " bicycle " lowered out of the way. Each suspension insulator assembly comprises six strings of twenty 14in diameter porcelain units in parallel, weighing nearly 3 tons and being $21\frac{1}{2}$ft in length. The erection tensions involved were of the order of 30-35 tons per conductor and all operations were directed by v.h.f. radio control. Stringing was completed at the rate of about one week per conductor.

All conductors, including the earth wire, have now been strung but the haulage and track ropes have yet to be dismantled. The river will have to be closed again for this operation which is expected to take place on 17th September or 1st October.

The total cost of the project is over £$\frac{1}{2}$ million and the main contractors to the C.E.G.B. are the British Insulated Callender's Construction Co., Ltd. The towers were fabricated by Painter Bros., Ltd., and Horseley Bridge & Thomas Piggott, Ltd., the detailed design being by Blaw Knox, Ltd. The foundation design consultants were Sir Alexander Gibb and Partners, the foundations being placed by Holloway Bros., Ltd., and Mears Bros., Ltd. The conductors were supplied by British Insulated Callender's Cables, Ltd., and Rylands Bros., Ltd., and the conductor erection equipment by J. Barnsley & Sons, Ltd. The anchor clamps and armour rods were supplied by Alcan Industries, Ltd.; the vibration dampers by Electric Transmission, Ltd.; the ropes by British Ropes, Ltd.; the insulator assemblies by Bullers, Ltd.; and winches by the Auto-mower Engineering Co., Ltd., and Henry Sykes, Ltd.

Ships' Electrical Regulations

A FOURTH edition of the Regulations for the Electrical Equipment of Ships has now been published by the Institution of Electrical Engineers and took effect on 1st September. For the preparation of this edition, in which the regulations have been completely reviewed and re-cast, the Committee on Regulations for the Electrical Equipment of Ships was reconstituted in 1955, and in particular its membership was extended by the addition of further representatives of shipbuilding and shipowning interests. Account has been taken of the considerable progress in standardisation through the British Standards Institution, particularly of cables, generators, motors, transformers and in radio interference suppression, which has taken place since the publication of the third edition in 1939 and its supplement in 1947 dealing mainly with new types of cable and the use of a.c. This has enabled reference to be made to the relevant Standards with consequent shortening of the Regulations.

At the request of the B.S.I., the Committee on Regulations for the Electrical Equipment of Ships acts for the British National Committee of the International Electrotechnical Commission in respect of work falling within the scope of I.E.C. Technical Committee No. 18 " Electrical Installations in Ships," and the work of preparing the fourth edition has proceeded closely in parallel with work for a second edition of the I.E.C. Recommendations for ships' electrical equipment. The first edition of the I.E.C. Recommendations was issued in 1957 and a draft second edition is now in an advanced stage of preparation. So far as national considerations permit, every attempt has been made to ensure that the fourth edition of the Regulations and the second edition of the I.E.C. Recommendations will be substantially in accord.

The new regulations apply equally to a.c. and d.c. installations utilising the following voltage ranges:—Extra low voltage, i.e. normally not exceeding 50 V r.m.s. a.c., with a maximum of 30 V to earth, or 50 V d.c.; low voltage, i.e. normally exceeding extra-low voltage but not exceeding 250 V; and medium voltage, i.e. normally above 250 V but not exceeding 650 V. Requirements for high voltage installations are not included except in respect of electric discharge lighting and propulsion systems.

Copies of the fourth edition may be obtained from the Secretary, Institution of Electrical Engineers, Savoy Place, W.C.2, price 7s 6d bound in limp cloth or 10s case-bound in cloth.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The following new appointments are announced by the Power Plant Division of the General Electric Co., Ltd., Erith, Kent, with responsibility to the divisional manager, Mr. D. M. Smith, M.I.E.E.:—

Mr. F. L. Tombs, A.M.I.E.E., formerly sales manager, Power Plant Division, has been appointed manager, engineering services, with executive responsibilities for the sales, tendering, contracts and operational services departments and for site resident engineers. After training with the G.E.C. at Witton, Mr. Tombs served with the Birmingham Corporation Electric Supply Department and the British Electricity Authority from 1946 to 1954 when he joined the G.E.C. Power Plant Division as operational services manager.

Mr. D. Kalderon, Ph.D.(Eng.), A.M.I.Mech.E., formerly chief development engineer, has been appointed deputy chief engineer. He joined the G.E.C. in 1955 as turbine design engineer, in which capacity he was responsible, through Mr. J. M. Mitchell, the chief engineer, for much of the large reheat machine development.

Mr. W. G. Rhodes, M.I.Mar.E., A.M.Inst.F., is now manager, home sales. He started with the Yorkshire Electric Power Co. in 1940 and later became boiler house superintendent at Brunswick Wharf power station, London Division, B.E.A. Further experience was gained as project engineer in the Engineering Division of the Reed Paper Group before he joined the G.E.C. in 1959, where he has been responsible for comprehensive power station contracts.



Mr. F. L. Tombs



Dr. D. Kalderon



Mr. W. G. Rhodes



Mr. D. C. Thorpe

Mr. D. C. Thorpe, B.A.(Hons.), is now manager, overseas sales. After obtaining his degree at Corpus Christi, Oxford, he served as a post-graduate apprentice with the G.E.C., subsequently taking up a post as sales engineer with the Westinghouse Electric International Company, New York. He returned to G.E.C. in 1960 as an overseas sales engineer.

Mr. Richard P. E. Tabb, B.Sc., A.C.G.I., M.I.E.E., has been appointed deputy director of engineering of the English Electric Co., Ltd. The Directorate is responsible for the engineering policy for the whole range of the company's products (other than those of English Electric Aviation) and Mr. Tabb will be mainly concerned with the company's technical development programmes. He joined the English Electric Co. as a graduate apprentice in 1929 and after three years in the A.C. Machine Design Department at Stafford he went to the United States as the company's liaison engineer with Westinghouse Electric Corporation. In 1937 he returned to Stafford as rolling mill drive engineer and in 1944 was appointed assistant to the company's chief engineer with responsibility for the coordination of development work.



Mr. R. P. E. Tabb

Mr. Tabb was made deputy chief engineer of the newly formed Guided Weapons Division in 1952 and two years later became assistant director of engineering at headquarters in London. He is a member of the B.S.I. Electrical Industry Standards Committee and the C.I.G.R.E. British National Committee.

Mr. A. Paterson, B.Sc., A.R.T.C. (Glasgow), M.I.P.E., has been appointed works manager, Trafford Park Works, A.E.I. (Manchester), Ltd., and **Mr. A. J. R. Veale,** Assoc.M.C.T., A.M.I.Mech.E., M.I.P.E., assistant works manager, with special responsibilities for the Manufacturing Services Department. Mr. Paterson has been assistant works manager since 1954. He started with the Metropolitan-Vickers Electrical Co., Ltd., as a college apprentice and was appointed superintendent, Motor Department, in 1945, undertaking the additional responsibility of assistant works manager of the M-V Mosley Road and Leonard works in 1952. Mr. Veale joined Metropolitan-Vickers as a school apprentice. In 1953 he was appointed assistant superintendent of the Radio Department and in 1954 assistant superintendent, Process and Rate Department, becoming superintendent shortly afterwards. He was appointed manager of the Manufacturing Services Department in 1959.



Mr. A. Paterson



Mr. A. J. R. Veale

Next year's president of the British Association for the Advancement of Science is to be **Sir John Cockcroft,** O.M., F.R.S., Master of Churchill College, Cambridge, and formerly director of the Atomic Energy Research Establishment, Harwell.

Mr. H. M. Hawkswood, who retired earlier this year as deputy manager, A.E.I. London regional office, spent 37 years in the service of the former Ferguson Pailin, Ltd., and Associated Electrical Industries, Ltd. He joined Ferguson Pailin (now the Higher Openshaw Unit of the A.E.I. Switchgear Division) in 1924 as a senior engineer in the estimating department. In the following year he was appointed manager of the Cardiff office. He transferred to London in 1927 and was



Mr. H. M. Hawkswood

appointed manager there in 1942. He was appointed a director of Ferguson Pailin in 1955, with special interest in export sales, and on the integration with A.E.I. became deputy manager of the group's London regional office.

The Yorkshire Electricity Board announces the appointment, as from 1st January, 1962, of **Mr. A. Haddock**, at present manager of No. 3 (Sheffield) Sub-Area, as chief commercial officer to succeed **Mr. A. Haselhurst** who will retire on 31st December next, after 35 years in the electricity supply industry, almost fourteen of which have been as chief commercial officer of the Board. **Mr. C. Booth**, who has been manager of the No. 2 (Huddersfield) Sub-Area for nine years, will also retire on 31st December.



Mr. A. Haddock

To fill these vacancies and that created by the death of Mr. D. R. Williams, manager of the No. 7 (Grimsby) Sub-Area, the Board will shortly be appointing managers in the Huddersfield, Sheffield and Grimsby Sub-Areas. Applications for the posts are invited in an advertisement in this issue.

Before the nationalisation of the electricity supply industry Mr. Haselhurst was commercial manager and deputy chief official in the Bradford Corporation Electricity Department; Mr. Haddock was distribution engineer and sales manager in the Sheffield Corporation Electricity Department; and Mr. Booth was borough electrical engineer and manager at Dewsbury.

Mr. C. R. Russell, manager—export sales, M-O Valve Co., Ltd., has been appointed product planning adviser to the company. He will retain his interest in sales while fulfilling his new responsibilities. Mr. Russell joined the parent company in 1947 and, until his appointment as manager—export sales of the M-O Valve Co. last December, he was engaged on valve research work at the Wembley Research Laboratories (now Hirst Research Centre) of the G.E.C.

Mr. Frank Simpson has been appointed director and general manager of Kenwood Manufacturing (Australia) Pty., Ltd., a subsidiary company of the Kenwood Group. Previously production manager of the group's Woking factory, Mr. Simpson became general works manager of the Australian company in 1959.

Mr. Frank Shutt, C.A., has been appointed financial comptroller to Hawker Siddeley Industries, Ltd.

Mr. J. M. Waldram, B.Sc., A.M.I.E.E., F.Inst.P., F.I.E.S., senior research lighting engineer of the General Electric Co., Ltd., left last week for a six-week visit to the United States and Canada. Mr. Waldram has been invited to present a paper on "Vision in Streets and Motorways" at the National Technical Conference of the American I.E.S., and a further paper on "Lighting and Architecture" at the School of Architecture, Toronto.

Mr. Maurice Biddulph, technical manager of Universal Metal Products, Ltd., has been appointed technical director of the company.

Mr. Stuart M. Rix, president of the Chartered Institute of Secretaries, left London Airport on Monday for Montreal to start a two-week tour of the Institute's branches in Canada. Mr. Rix is deputy chairman of the Southern Electricity Board.

Mr. H. W. Thompson has relinquished his position as commercial manager of the major domestic appliances group of Philips Electrical, Ltd. He is succeeded by **Mr. W. F. Cassidy**, who has been manager of Philips' South-East Region since 1959. Before that he was Midland regional manager.

Mr. John O. Sewell, a Canadian accountant, has been appointed as chairman and managing director of G.E.C. (Lighting & Equipment) Holdings, Ltd., from 1st September. He served with the Yale & Towne Manufacturing Co. in North America and Europe in various management posts and was its managing director in the United Kingdom and a vice-president of its international operations.



Mr. J. O. Sewell

Mr. W. H. Beswick has been appointed assistant superintendent of the Meter Department at the Motherwell Works of Associated Electrical Industries, Ltd.

Mr. C. E. G. Nye, M.C., has retired from the board of George Cohen, Sons & Co., Ltd., after 40 years' service with the group. He has for many years been closely associated with the publication of the "*600*" *Magazine*.

OBITUARY

Mr. G. R. Thursfield.—The death occurred on 26th August of Mr. Greville Richard Thursfield, M.I.Mech.E., F.Inst.F., a former chairman and managing director of the Sturtevant Engineering Co., Ltd. Born in Broseley, Shropshire, in 1874, he was educated privately in England and then at the Technical School in Vienna before returning to the City & Guilds of London Institute to complete his studies in electrical engineering. Returning to Austria, he spent several years in the Thursfield Engineering Works at Gumpoldskirchen and in 1898 joined the Sturtevant Engineering Co., Ltd. For several years he managed the Berlin branch of that company and in 1915 he was appointed chief engineer and director in London. Mr. Thursfield became chairman and managing director of the company in 1941. He retired from the latter position in 1951 and relinquished the chairmanship in 1958. Mr. Thursfield was a founder member of the Institute of Fuel, of which he was elected a vice-president in 1941. He was also a director of the Bifurcated Rivet Co., the Crosby Valve & Engineering Co., and the Igranic Electric Co.

Mr. W. W. Hughes.—The death occurred in South Africa on 16th August of Mr. W. Walter Hughes, M.I.E.E. Mr. Hughes, who was 89, served his apprenticeship with Crompton & Co. He was then appointed manager of the British Westinghouse Co.'s Cardiff office, and later was promoted to manager of the Plant Department at the Old Trafford Works, Manchester. During this period he actively collaborated with the late Mr. Dunlop in the formation of the British Electrical & Allied Manufacturers' Association. From 1911 to 1925 he practised as a consulting mechanical electrical and mining engineer under the style of W. Walter Hughes & Associates. He then reverted to the manufacturing industry, and was the founder and chairman of the Hackbridge Electric Construction Co., Ltd., the Hewittic Electric Co., Ltd., and the New Switchgear Construction Co., Ltd., which were purchased in 1944 by the Anglo Scottish Amalgamated Corporation, Ltd. Mr. Hughes was an honorary member of the Institution of Electrical Engineers and a vice-president of the B.E.A.M.A.

Mr. F. Bond.—The death occurred recently of Mr. Fred Bond, sales director of Newton Brothers (Derby), Ltd., with whom he had been associated for 34 years.

INDUSTRIAL NEWS

Colour Television Tubes

A DEMONSTRATION was given last week of a colour television tube being developed at the Sylvania-Thorn Colour Television Laboratories at Enfield. The tube has a single electron beam, unlike the American "shadow mask" tube where three separate images are projected on to the screen from three electron guns, and is known as the "Zebra" tube because the screen consists of a series of vertical stripes of red, green and blue phosphors spaced at 25 three-stripe groups per inch. The scanning spot traverses these at right angles in a red, green and blue sequence. The electron beam is modulated to excite the appropriate colour phosphors so that the resultant picture is made up of the correct combinations of primary colours.

To ensure that the colour signals applied to the electron gun are synchronised with the spot position so that the correct colours are excited, index stripes are provided on the inside of the screen structure. These are located between every two or four groups of the colour phosphor stripes and when energised emit ultra-violet radiation, which is detected by a photoelectric cell. The output from this cell is used to synchronise the scanning and modulation circuits. If the electron beam is not modulated to give a colour picture, a satisfactory black and white picture is obtained.

The tube is suitable for both 405- or 625-line pictures and can work with both the American N.T.S.C. and French SECAM colour transmission systems, although the circuitry involved with the latter would result in a more expensive receiver. Although several more years of development work are necessary before this tube can be incorporated in commercial receivers, the company hope that ultimately it will result in the production of a colour receiver at a price down to $1\frac{1}{2}$ times that of a black and white receiver.

NEW G.E.C. HOLDING COMPANY

G.E.C. (Lighting & Equipment) Holdings, Ltd., is being formed as a wholly owned subsidiary of the General Electric Co., Ltd., and as a holding company for the Lighting and Heating and Installation Equipment Groups.

The formation of the G.E.C. (Lighting & Equipment) Holdings, Ltd., is in line with the corporate policy of the G.E.C. in establishing holding companies for two or more groups, or divisions, of the company. The new headquarters will be in Newhall Street, Birmingham, and Mr. J. O. Sewell has been appointed chairman and managing director (see page 396).

NIMROD INJECTOR

The 15 MeV linear accelerator injector, which forms the first stage of NIMROD, was commissioned on 1st August. NIMROD is the 7 GeV proton synchrotron which is under construction at the Rutherford High Energy Laboratory of the National Institute for Research in Nuclear Science, Harwell. Pulsed beams will be delivered by the injector to the synchrotron at rates up to 2 per sec and at pulse lengths up to 2 msec. Construction work on NIMROD started in August, 1957, and is expected to be completed during 1962.

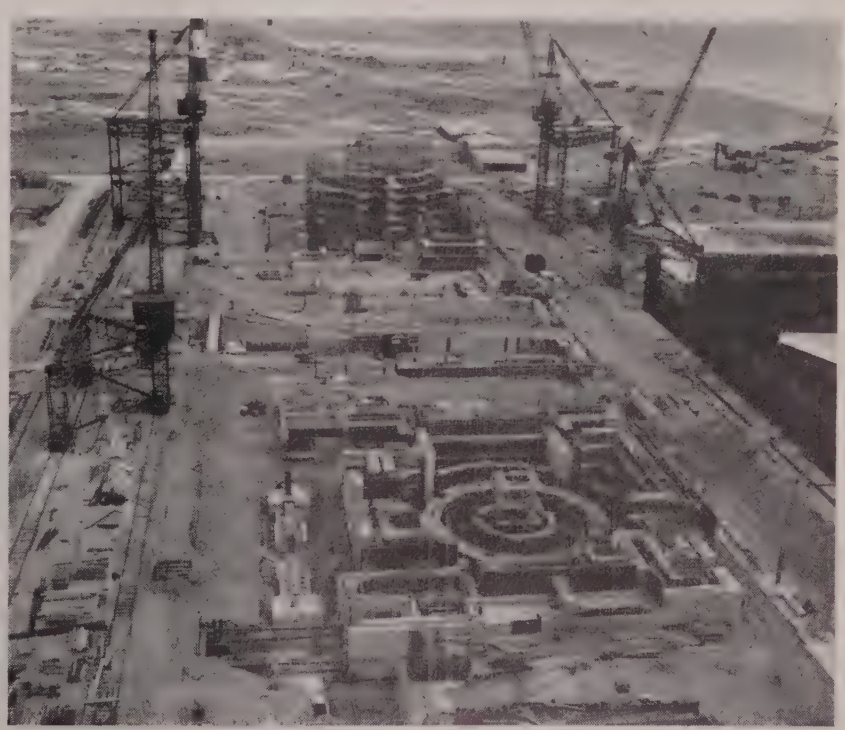
Changing Pattern of Fuel Consumption

The increasing use of electricity and oil at the expense of other fuels over the past ten years is shown in the "Ministry of Power Statistical Digest, 1960," published last week (price £1 7s 6d).

While total fuel consumption (measured in million tons of coal equivalent) rose between 1950 and 1960 by 18 per cent to 264 million tons, consumption of electricity rose by over 90 per cent to 64 million tons and the direct use of oil increased two and a half times, to 55 million tons. Over the same period electricity consumption as a proportion of total fuel consumption rose from 17 per cent to 25 per cent, while the direct use of oil increased from 10 per cent to 21 per cent of the total.

Out of a total domestic consumption of 70 million tons of coal equivalent in 1960 (63 million tons in 1950) coal accounted for 35 million tons (37 million tons), gas 8 million tons (10 million tons), electricity 20 million tons (11 million tons) and oil 3 million tons (1 million tons).

DUNGENESS NUCLEAR POWER STATION



A recent view of progress made on Nos. 1 and 2 reactors of the 550 MW nuclear power station at Dungeness. No. 1 reactor, in the foreground, is more advanced than No. 2 and the biological shield which will surround the pressure vessel is approximately 50 per cent complete. The photograph was taken from the top of the 400-ton Goliath crane which is nearing completion. Work started at the Dungeness site on 1st August, 1960. The station, being built for the Central Electricity Generating Board by the Nuclear Power Group, should be completed by the end of 1964 or early 1965

INDUSTRIAL NEWS *[continued*

CHANGES IN EXPORT LICENSING CONTROL

THE Board of Trade announce certain changes in export licensing control effective from 12th September. These changes result from amendments to the list of goods subject to embargo for the Soviet bloc and China, the revised list of which was published in the *Board of Trade Journal* on 11th August.

Among the changes, control is imposed on the export of specified components of electronic computers and on specialised parts of specified vacuum induction furnaces to countries other than Commonwealth countries, the Irish Republic and the United States.

The descriptions of goods to which export control applies have been amended in the case of centrifuges, dosimeters, electrolytic cells, heat exchangers, nuclear reactors, specified direction finding equipment, control equipment, electronic and precision instruments and apparatus, cathode-ray oscilloscopes, electronic cathode-ray tubes, vacuum tubes and valves, photo-electric cells, radio transmitters and transmitter amplifiers, and recording and reproducing equipment.

Permanent Magnet Alloy

A data sheet, describing their cobalt-platinum permanent magnet alloy Platinax II, has been issued by Johnson, Matthey & Co., Ltd. This material is the latest development in magnetic alloys of the cobalt-platinum system, and has a BH(max) of 9·2 x 10^6 gauss-oersteds. Before its final heat treatment it can be rolled, drawn, or machined. As well as general data, the new publication gives information on the heat treatment process, on reversible permeability, and on behaviour at elevated temperatures. Copies are available from the company at 73-83, Hatton Garden, London, E.C.1.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £235 12s 6d
Fire Refined 99·70%	ton £234 0s 0d
Fire Refined 99·50%	ton £233 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £268 5s 0d
H.C. Wire and strip	ton £285 5s 0d
LEAD, English ..	ton £64 10s 0d
Foreign	ton £63 0s 0d
MERCURY	flask £63 0s 0d
TIN, block (English) ..	ton £986 10s 0d
ZINC, G.O.B. Foreign	ton £75 7s 6d
BRASS Tubes (solid drawn)	lb 1s 10⅛d
Wire	lb 2s 8¾d
PHOSPHOR BRONZE Wire	lb 4s 2½d
PLATINUM	oz £30 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 25½d—25⅝d

Computer for French Supply Industry

Wayne Kerr Laboratories, Ltd., have received their first order from abroad for a transfer function computer. It has been placed by Electricité de France.

Electricité de France are engaged on analogue computations of transmission line problems, and will use the computer in a method that involves setting up the transfer function of line networks. The Wayne Kerr transfer function computer measures the performance of control systems and indicates corrective networks in a matter of minutes with an unvarying accuracy of 1 per cent.

Autumn Lighting Campaign

A three-dimensional showcard has been produced advertising the "Brite-Glo" packaged lighting units of Courtney, Pope (Electrical), Ltd. These 14in by 10in showcards are produced to coincide with the autumn retail selling campaign.

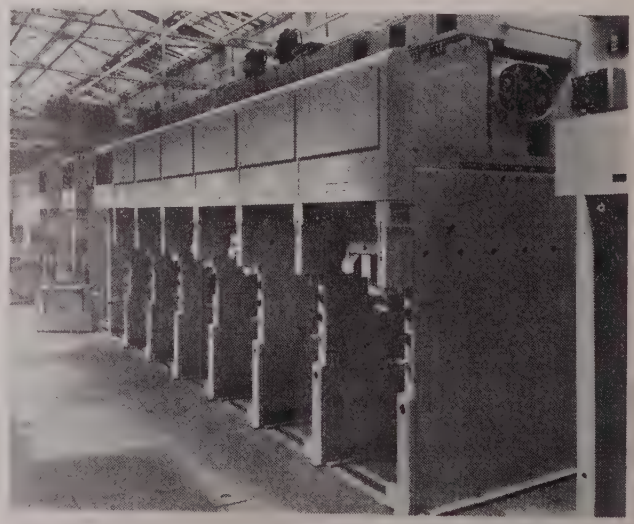
Mobile Radio Equipment Agreement

It is announced that arrangements have been made for Storno-Southern, Ltd., to take over responsibilities for marketing, servicing and installing G.E.C. mobile radio equipment as from 4th September. To ensure close technical liaison and continuity of current commitments, certain engineering staff are being transferred from the G.E.C. to Storno-Southern, Ltd., who have established an office with sales and servicing facilities and a spares depot at 2, Arbury Avenue, Coventry (telephone: Coventry 87521). The G.E.C. are continuing to manufacture their range of communication equipment on a contract basis. Storno-Southern, Ltd., are already manufacturing frequency modulated equipment, and are now able to offer G.E.C. amplitude modulated equipment.

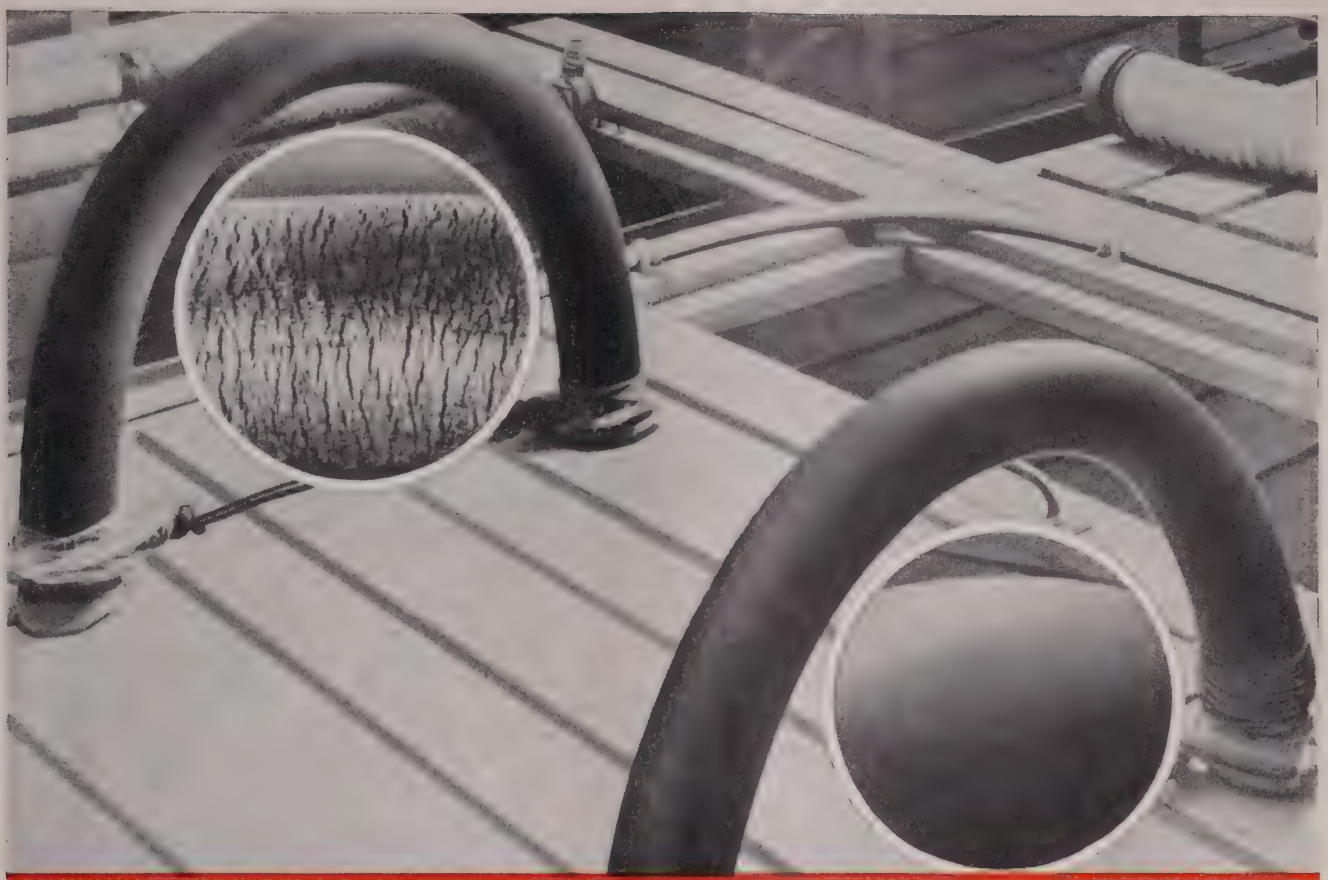
WESTERN EUROPEAN TAXATION

A third (revised) edition of "Taxation in Western Europe" has been published by the Federation of British Industries, 21, Tothill Street, London, S.W.1, at 20s. This work is the successor of a monograph which first appeared in 1957 as "Taxation in the Proposed Free Trade Area." It gives in fair detail the various methods and rates of taxation in fifteen countries (including the United Kingdom), covering both E.F.T.A. and the European Economic Community (the "Common Market"). An introductory section describes the various forms of tax adopted in a comparative manner. It is proposed to issue the book regularly in June in future.

Switchgear for Steelworks



A 33 kV type L42T/L45T switchboard under construction at the Hebburn Works of A. Reyrolle & Co., Ltd. The switchboard is part of a £1 million contract for switchgear and associated equipment for the new Spencer Works of Richard Thomas & Baldwins, Llanwern, Monmouthshire



CABLE JACKET OF DU PONT NEOPRENE IS STILL TOUGH AND LIVELY AFTER 24 YEARS

These photographs show test cables that have been fixed in a bent position under stress to increase their vulnerability to surface cracking. This exposure to outdoor wear over a period of 24 years proves the outstanding durability of Du Pont neoprene. See how the natural rubber jacket on the left has been cracked and weakened by the weather. The jacket made from Du Pont neoprene on the right, however, is still lively, resilient and tough.

Du Pont neoprene combines many properties that make it far superior to other jacketing materials. It has remarkable heat and flame resistance. It has excellent properties over a wide temperature range and can be compounded to remain flexible at –65° F, at the other extreme it has proved serviceable even upon brief, intermittent exposure to 500° F. Du Pont neoprene gives increased safety, too, because it will not propagate flame and it helps cut down the danger of fires.

Du Pont neoprene, in fact, offers balanced resistance to all the causes of deterioration—weather, sunlight and ageing; flame and ozone; oil and grease; many organic and inorganic chemicals; soil acids and galvanic action . . . as well as severe impact, abrasion and cutting. Ask your supplier about wire and cable jacketing made from Du Pont neoprene, and send the coupon below for a free copy of "What neoprene is—and how it protects wire and cable."

Du Pont Company
(United Kingdom) Ltd.
76 Jermyn Street,
London, S.W.1.

DU PONT
REG. U.S. PAT. OFF.
Established 1802

DU PONT NEOPRENE

BETTER THINGS FOR BETTER LIVING . . *THROUGH CHEMISTRY*

ELECTRICAL REVIEW 9/61

Du Pont Company (United Kingdom) Ltd.
76 Jermyn Street, London S.W.1, England.

Please send copy of "What neoprene is—and how it protects wire and cable." *I am particularly interested in*.....
.....

L

NAME _____

POSITION _____ COMPANY _____

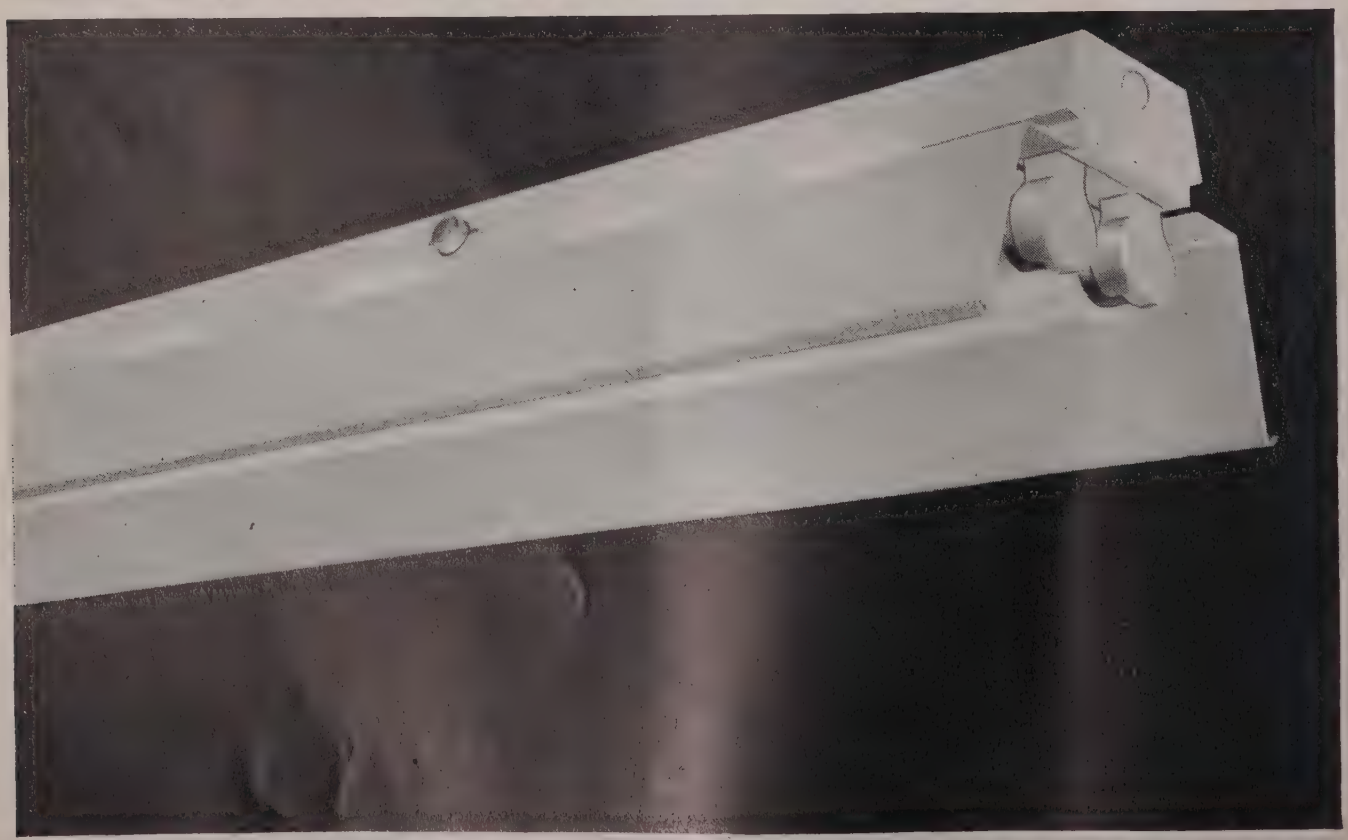
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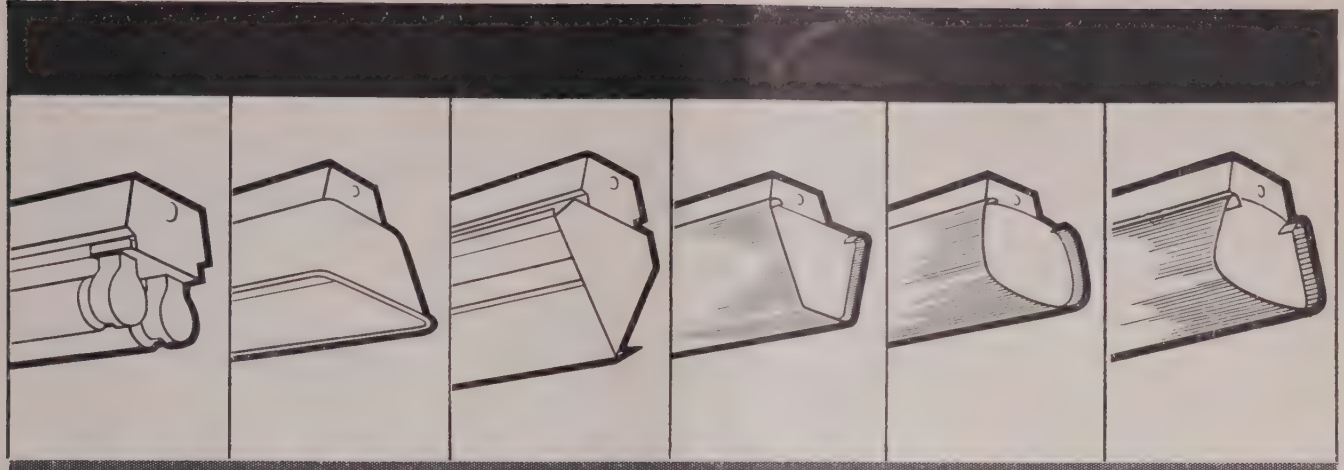
CITY _____ COUNTRY _____

NEW

DURHAM RANGE

LIGHTING FITTINGS





a complete and compact range

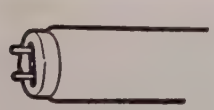
- ✻ Switchstart and quickstart throughout range
- ✻ Easy installation and maintenance
- ✻ Superbly engineered

PRODUCED BY **EKCO**

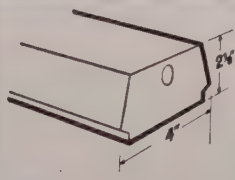
- ✻ Competitive price
- ✻ Quality materials and manufacture
- ✻ Wide range of quick-fix reflectors and diffusers

LIGHTING ADVISORY SERVICE
Ekco-Ensign operates a Lighting Advisory Service throughout Great Britain. Qualified Lighting Engineers will be pleased to call on you, discuss your particular problem and to prepare detailed lighting schemes. This service is entirely free and without obligation.

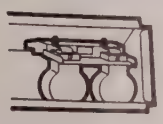
EASY ASSEMBLY AND MAINTENANCE



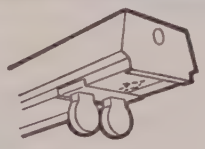
Tubes
For 8 ft., 5 ft. & 4 ft. single and twin.
Also 85w 8 ft. twin.



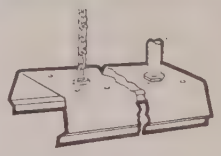
Spine
Identical strong shallow section for all tube sizes—single and twin.



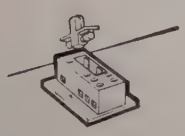
Packing
All fittings separately cartoned. Lampholder platforms ready-wired packed in spine.



Lampholder Platform
Platform locked into position without tools. Lampholders cannot be reversed on twin fittings.



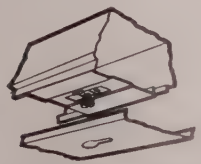
Installation
For chain, conduit or direct-on-ceiling. Knockout at centre and in endplates.



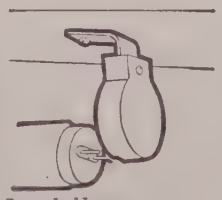
Fused Terminal Block
3-way block for fitting protection—easily replaceable B.S. cartridge fuse.



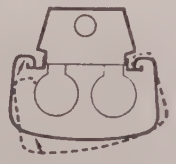
Starter Switches
Instantly accessible without dismantling fitting.



Reflectors & Cover Plates
Quickly and easily attached by a simple locking device.



Lampholders
White, plastic, sprung, bipin for positive operation.



Diffusers
Positively attached to spine by simple swing-over action.

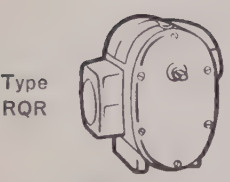
EKCO-ENSIGN ELECTRIC LIMITED. 45 Essex Street, Strand, London WC2 Telephone: CITy 8951

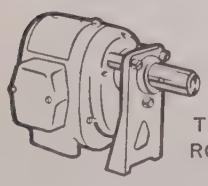
Sales Offices, Illuminating Engineering Depts., Showrooms and Depots LONDON • MANCHESTER • BIRMINGHAM • NOTTINGHAM • GLASGOW • CARDIFF

37 STANDARD SPEEDS

from 57 mins. per rev. to 2,700 revs. per min.

Type RQR

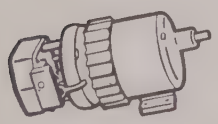




Type RQ 53

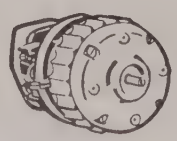
No other motors offer the wide range of speeds, torques and programme switching of the versatile Drayton RQ. Conforming to BSS 170/1939, it is suitable for continuous or intermittent running; reversing; and can also be supplied with or without internal limit and programme switches. Motors giving a shaft rotation of more than one revolution before switching operates, or with multi-position switching, are also available. Write now for your copy of Data Sheet No. 302.

Type RQH

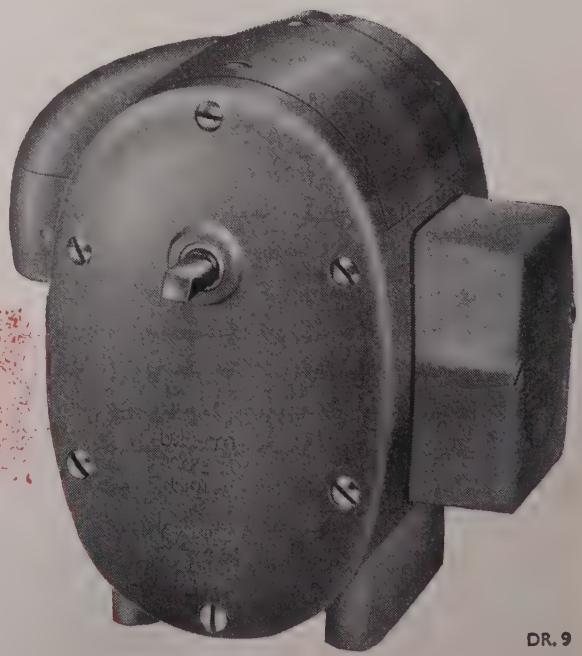


Type RQU





Type RQG



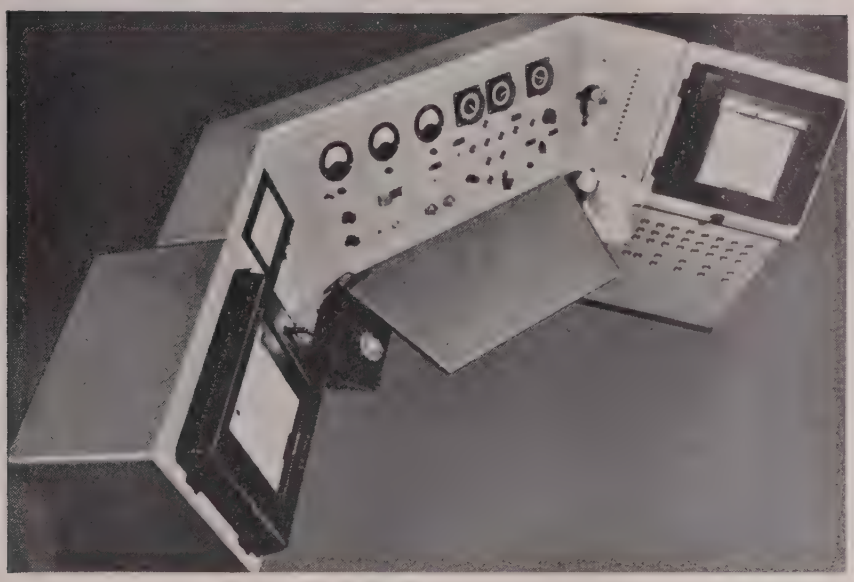
DRAYTON 'RQ' MOTORS

DRAYTON CONTROLS LIMITED
Bridge Works, West Drayton, Middx. *Phone: West Drayton 4012*

DR. 9

INDUSTRIAL NEWS *[continued*

NEW INSTRUMENTATION FOR D.M.T.R.



The new control console recently installed in the materials testing reactor (D.M.T.R.) at Dounreay was designed and manufactured by James Scott (Electronic Engineering), Ltd., in conjunction with the instrumentation and operating staffs of D.M.T.R. It is arranged to carry all controls for starting up and shutting down the reactor, together with the most important parameter instruments

Traffic Control Exhibition

THE control of traffic flow by automatic devices is the theme of a small exhibition at the Science Museum, South Kensington, from 13th September until 1st October. This modern traffic control exhibition has been arranged by the Westinghouse Brake & Signal Co., Ltd., to coincide with the opening at the Museum, by Lord Brabazon of Tara, of the London Conference of the International Commission for Transport Museums. It illustrates, by actual equipment and working models, a few of the types of device employed in controlling traffic on road and rail. On view will be a model which shows how the points and signals in a particular signalling location are controlled from a central cabin which also receives an indication of the condition of the remote points and signals and the position of trains passing, an automatic level crossing barrier machine and its associated equipment and equipment for varying the width of traffic lanes at the approach to main junctions or cities according to the direction and volume of traffic. The Science Museum is open on weekdays from 10 a.m. to 6 p.m. and from 2.30 p.m. to 6 p.m. on Sundays.

English Electric Division Re-named

The scope of the Mining Division of English Electric Co., Ltd., Stafford, has been extended and it will in future be known as the Mining and Materials Handling Division. It will be responsible for comprehensive schemes involving the application of electrical equipment to bulk and raw materials handling and processing.

SEAT RESERVATION SYSTEM FOR B.E.A.

A contract worth £2·5 million has been awarded to Standard Telephones & Cables, Ltd., by British European Airways for a new push-button reservation system. The contract is for the first part of an electronic, automatic seat-booking system which, at an estimated ultimate cost of £4·5 million, will be the biggest of its kind in Europe and one of the most modern and most fully-automated systems employed by any airline in the world.

EDUCATIONAL

The Rutherford College of Technology, Newcastle-upon-Tyne, has issued its prospectus for 1961-62 and a booklet giving details of special advanced courses.

SWISS RAILWAY ELECTRIFICATION

Last year the Swiss Federal Railways published a brochure as an official record of the completion of the electrification of their system. It was in French and German. The book has now been translated into English by some of the officers of the Eastern Region of British Railways and, under the title "The Swiss Federal Railways' Electrification Completed," appears as a handsome production of 143 pages with numerous diagrams and illustrations.

The subject is dealt with historically, mechanically and electrically and very full details are given of the power supply system, and the construction and operation of the locomotives by the principal engineers of the Swiss Federal Railways. The book is available (at 15s) from the London office of the S.F.R., 458-459, Strand, W.C.2, or Ian Allan, Ltd., Craven House, Hampton Court, Middlesex.

Peruvian Communications Network

The General Electric Co., Ltd., has been awarded a $3 million contract by the Compania Nacional de Telefonos del Peru to supply the radio and multiplexing equipment for a microwave network linking the towns of Arequipa, Lima, Trujillo, Chiclayo and Piura in Peru.

The network, comprising ten terminal and 54 both-way repeater equipments, will be the longest in South America, extending for 1,100 miles along the Pacific seaboard. A main and a protection radio frequency channels operating in the 2,000 Mc/s band will be provided on all routes. The contract was secured against strong American competition.

North of Scotland Extension

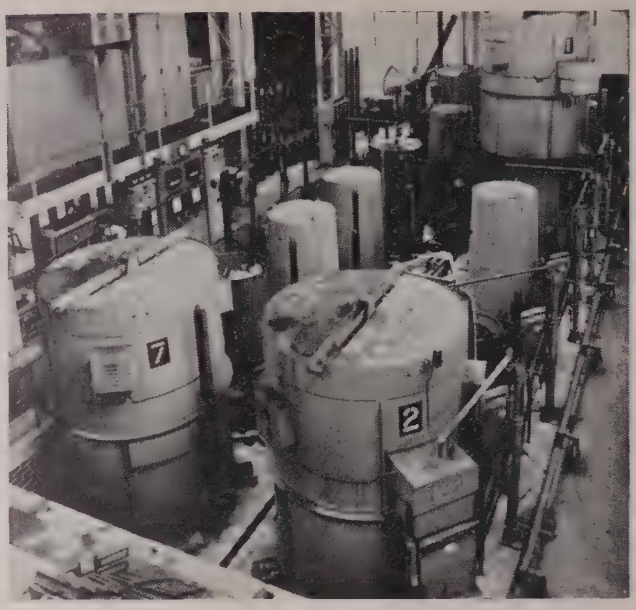
The North of Scotland Hydro-Electric Board are to extend their 132 kV main transmission network from the existing termination at Mybster transforming station to the outskirts of Thurso to meet the rapidly increasing demand for electricity in the north of Caithness. The extension will consist of 10½ miles of steel tower line of double circuit construction which will operate initially at 33 kV and later at 132 kV. The existing 30 MVA transformer capacity at Mybster transforming station will be doubled and when the line voltage is uprated, two 20 MVA, 132/33 kV transformers will be installed at Thurso.

INDUSTRIAL NEWS *[continued*

COPPER ANNEALING FURNACES

A NEW building has been erected at the Forge Lane, Manchester, works of Richard Johnson & Nephew, Ltd., for bright annealing copper wire and strip. The centre of the building is used for charge handling and on both sides provision is made for two parallel production lines each consisting of two furnaces and eight bases. Three of these production lines are in operation and foundations have been laid for the fourth to complete an eight-bell 32 base installation, each base capable of accepting a 2 ton charge. The protective atmosphere is supplied by five Efco exothermic generators, each having a capacity of 2,000 ft^3/hr, mounted on an overhead platform along one side of the new shop.

The furnaces, supplied by Efco Furnaces, Ltd., operate at temperatures up to 550°C and are rated at 120 kW. They are heated by elements of nickel-chromium strip supported around the chamber walls. The temperature of each furnace is controlled automatically with an indicating and recording instrument housed with contactors, fuses and pilot lights in separate floor standing cubicles. Electrical connections are made automatically as the furnaces are lowered over a charge with an audible indication should an atmosphere recirculating fan fail to operate.



Two production lines for bright annealing copper wire and strip at the works of Richard Johnson & Nephew, Ltd., each comprising two Efco bell furnaces and eight bases

New Synthetic Rubber

It is announced that the International Synthetic Rubber Co., Ltd., Hythe, Southampton, have been appointed sole U.K. agents for "Diene" rubber by the Firestone Synthetic Rubber & Latex Co. of Akron, Ohio, and can now offer this material ex stock to users in this country. This stereospecific polybutadiene rubber has outstanding resilience, low hysteresis loss under conditions of constant force, and excellent low temperature properties. Blended with natural rubber it provides material for motor car tyres which is superior to conventional rubber, largely because of its high resilience. Other applications of this material include motor mountings, bushings, and vibration dampers. "Diene" rubber is claimed to possess electrical properties which make it suitable for cable insulation.

HEATING INSTALLATION IN HAMMERSMITH FLYOVER

The heating of the road surface of the new Hammersmith flyover will be by means of approximately 66 miles of heating cables laid in panels and provided by the Panelec Heating Division of British Insulated Callender's Cables, Ltd. The flyover will, it is believed, be the first in the world to be completely heated.

LOWER AIR CARGO RATES

BRITISH exporters of a wide range of household electrical goods to Canada and the United States will benefit from cheaper cargo commodity rates to Montreal and New York instituted on 1st September on all B.O.A.C. flights from London, Manchester and Glasgow. The new rates (subject to Government approval), which also apply to importers, range from 6s 4d per kg for consignments of more than 45 kg to 5s 9d per kg for more than 100 kg.

The rates apply to radio, television, phonograph and sound recording sets for household use, as well as a wide range of other household electrical goods including dish washing machines, drying machines, floor polishers, freezers, frying pans, grillers, hot plates, ironing machines, kettles, lamps, mixers, pressure cookers, refrigerators, vacuum cleaners, sewing machines and toasters. For consignments of 1,000 kg or more the rate is 5s 2d per kg to New York and 5s 1d to Montreal.

Lower commodity rates are now also available for British exporters of bulk electrical machinery. These rates are: 6s 4d for consignments of between 45 and 249 kg; 5s 9d for from 250 to 999 kg; and 4s 11d for consignments of 1,000 kg and over. These rates cover electronic control panels (and parts) for automatic telephone and teletype exchange installations, radar stations, power plant, heating and cooling installations, and sound recording studios and electronic tubes.

Technical Writing and Speaking

Important aspects of communications for management are dealt with in two courses of lectures which the Borough Polytechnic have organised for this autumn. The first will consist of six lectures by a panel of speakers on "The Technique of Technical Writing" to be given at 2.30 p.m. on Friday afternoons commencing 20th October. The second will consist of ten lectures to be given by Mr. Stedwell Fulcher on "Effective Speaking" at 7 p.m. on Monday evenings commencing 9th October.

Heating and Ventilating Exhibition

The first International Heating, Ventilating and Air Conditioning Exhibition is to be held at Olympia, London, from Tuesday, 26th September, until Friday, 6th October. During the exhibition there will be an international conference on heating, ventilating and air conditioning organised by the Institution of Heating and Ventilating Engineers from 27th September until 4th October.

Successful G.E.C. Show

During the six days of the "New TV Show," arranged at the New Horticultural Hall, Westminster, by the General Electric Co., Ltd., 102,465 visitors passed through the turnstiles and the company says that business was "exceedingly brisk."

European Marketing Plan for Inertial Guidance Systems

British Aircraft Corporation, Ltd., and Minneapolis-Honeywell Regulator Co. have formed a joint organisation to develop, manufacture and market inertial guidance systems for aircraft and missiles in Europe. The organisation will be called "Inertial Guidance —Europe" and the headquarters in Paris will be staffed by representatives of both companies.

Products included in the agreement are inertial guidance systems, inertial reference systems and associated electronics for both aircraft and missiles. The companies will participate jointly in all facets of the programme, including marketing, development, design, production and field service. The marketing structure maintained by each company for the sale of other products in Europe is not altered.

Steelworks Automation Company

The A.E.I./Davy-United Steelworks Automation Unit, which was formed in July, 1960, to apply automation to the processing of steel and non-ferrous metals, will henceforth trade in its own right. The interests of Associated Electrical Industries, Ltd., and Davy-Ashmore, Ltd., in this field are now combined in a jointly-owned company, Davy-A.E.I. Automation, Ltd. The chairman of the new company is Mr. M. A. Fiennes, managing director of Davy-Ashmore, Ltd., and the vice-chairman is Mr. C. R. Wheeler, vice-chairman of Associated Electrical Industries, Ltd. The headquarters of the company will be at Booths Hall, Knutsford, Ches.

CABLE SHEATHING BOOKLET

The production, properties and uses of lead cable sheathing are described in a booklet recently produced by the Lead Development Association. Details are given of sheath extrusion, lead alloy compositions and applications and typical lead sheathed power and communications cables. Copies are available from the Association at 34, Berkeley Square, London, W.1.

Electronic Exhibition

The 5th Electronic Components International Exhibition will be held in Paris from 16th to 20th February, 1962. The exhibition is organised by Fédération Nationale des Industries Electroniques Françaises and about 24 British companies will be represented. Further details can be obtained from S.D.S.A., 23, Rue de Lubeck, Paris, 16.

TRADE ANNOUNCEMENTS

A new service branch has been opened by **Black & Decker, Ltd.**, at 1, Brixton Road, London, S.W.9. It will be known as the South London service branch and the two existing London branches at Harmondsworth and Holloway Road will now be known, respectively, as the London West and London North branches. Mr. W. C. May, previously branch service engineer at Holloway Road, has been appointed branch service engineer of the new branch, and Mr. W. Hickie will replace Mr. May at the Holloway Road branch.

British Insulated Callender's Cables, Ltd., have established a new depot in Coventry within the organisation of the B.I.C.C. Midlands Region. The address is 37, Broad Street (telephone: Coventry 89600). The new depot serves the Birmingham branch and is under the management of Mr. E. Appleton.

Automatic Control Engineering, Ltd., have opened a new northern area design office at 15, Bloom Street, Manchester, 1 (telephone: Central 1462). The northern area manager is Mr. R. S. Seagrave, B.Sc.(Eng.).

Hellermann, Ltd., a subsidiary of Bowthorpe Holdings, Ltd., have established a Midland area sales office at Bowthorpe House, 380, Boldmere Road, Sutton Coldfield, Warwickshire (telephone: Erdington 6868). Mr. A. Newnes has been appointed area sales manager at the new office.

H. Frost & Co., Ltd., manufacturers of "Sunhouse" electric fires, have completed a large extension at their Walsall factory. The new plant is already in production.

Mr. L. J. Burrows, of 106, Willbye Avenue, Diss, Norfolk (telephone: Diss 2529), has joined **Sunbeam Electric, Ltd.**, as area representative for the Eastern Counties and Oxfordshire.

Wild-Barfield Electric Furnaces, Ltd., have rearranged their area representation as follows (the undermentioned will also represent the Furnace Division of G.W.B. Furnaces, Ltd.):—*Birmingham and East Midlands*: 71, Broad Street, Birmingham, 15 (telephone: Midland 7232). Area manager, Mr. G. W. Haines; sales engineers, Messrs. R. E. Butchers and C. A. McNeill. *West Midlands*: 39, Peterdale Drive, Penn, nr. Wolverhampton (telephone: Wolverhampton 38450). Sales engineer, Mr. A. V. Skelsey. *South Wales*: Ty-Mawr, Peterston-super-Ely, Glam. (telephone: Peterston 293). Sales engineer, Mr. T. M. Morgan. *Sheffield and North Midlands*: 1, Clarkehouse Road, Sheffield, 10 (telephone: Sheffield 62784). Area manager, Mr. E. J. Heiser, M.I.E.E.; sales engineers, Messrs. D. N. Greensmith and D. J. Sutherland. *Northern England*: 7, Gordon Road, Redcar, Yorks (telephone: Redcar 5197). Sales engineer, Mr. R. Flanagan.

Lloyd Instruments, Ltd., and their subsidiary company, H. Millington, are moving to larger premises at Furrow Lane, Homerton High Street, London, E.9 (telephone: Amherst 6578).

The **Metallic Seamless Tube Co., Ltd.**, have extended their London depot at 86-88, Goswell Road, E.C.1, where a new trade counter and increased warehouse space have been provided.

The Nottingham office of the **A.E.I. Lamp & Lighting Co., Ltd.**, has been moved to Ashforth Street, Alfred Street Central. The telephone number remains Nottingham 51115.

J. H. Fenner & Co., Ltd., state that their Glasgow branch is now on Telex. The number is 77269.

CLOSED-CIRCUIT TV EXHIBITION

The application of Grundig closed-circuit television and instrumentation to industry and commerce will be shown at an exhibition to be held by Wolsey Electronics, Ltd., at 39/41, New Oxford Street, London, above Grundig (Great Britain), Ltd.'s showroom, from 18th to 22nd September. Included in the display will be internal closed-circuit operation, long distance operation using a zoom type lens, and a camera will also be used in conjunction with film projection for tele-ciné equipment. Various selected units of the Grundig instrument range will also be shown.

New E.I.B.A. Branch

A local branch of the Electrical Industries Benevolent Association under the chairmanship of Mr. John Bailey (Brook Motors, Ltd.) has been formed in the Huddersfield and Halifax area. The committee is composed of representatives from local electrical industries, manufacturing wholesalers and Area Board officials in the area.

NEW ELECTRICAL EQUIPMENT

DAYLIGHT-OPERATED SWITCH

A small automatic daylight-operated switch, designed to control shop, factory and street lighting, signs and shop blinds automatically, is now being manufactured by HIRD-BROWN, LTD., 244, Marsland Road, Sale, Cheshire.

The switch incorporates a cadmium sulphide photo-conductive cell made by National Semiconductors, Ltd., of Montreal, Canada, for whom Hird-Brown are the sole agents in the United Kingdom. The switch case measures 6in by 3in by 2in and it can be drilled and fitted in any position. The switch, which can be set to switch on and off at any level of daylight, is suitable for all climates and is fully compensated for variations in temperature. It operates on 100/110 or 200/250 V a.c., single-phase, 50-60 c/s, and incorporates a time delay so that it is not affected by short-term light changes. Marketed as the NCS unit, its price is £9 15s. Also produced by Hird-Brown, Ltd., is the N2CS unit which has two photo-conductive cells, each independent, so that the switch-on light level can be different from the switch-off level. Its price is £15 10s.

LOOP IMPEDANCE TESTER

The earth fault loop impedance tester type ET20 manufactured by BRADMATIC, LTD., Station Road, Aston, Birmingham, 6, is designed to check the effectiveness of socket and apparatus earthing in accordance with I.E.E. Wiring Regulation No. 508. The instrument employs the current injection neutral earth method of establishing the impedance of earth return circuits. In addition to checking the outlet socket polarity, it will measure the earth return path of outlets, switchgear, conduits, portable apparatus and tools. A control is provided to counteract the effect of any external interconnection leads which may be used and also to compensate for mains supply voltage variation. The test voltage cannot exceed 4 V and the maximum test current is 20 A.

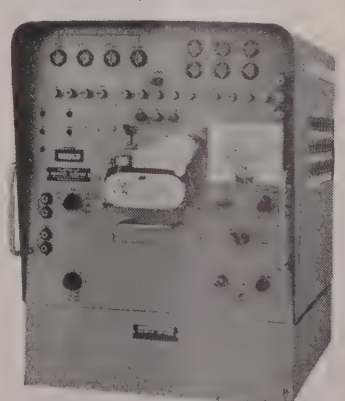
Normally the instrument's internal earth lead is used during test, but provision is made to isolate this and connection can then be made to any convenient part in the circuit. The impedance of leads is indicated directly on a 4in meter with a range of 0-2 Ω and large terminals are provided on the front panel for external connections. A set of leads and heavy duty clips are supplied. It is housed in a steel case measuring 14in long by 9½in high by 7in deep and weighs 27 lb. Operation is from a 220-240 V, 50 c/s supply and the consumption is 90 VA. The price is £45.



Bradmatic earth fault loop tester

AUTOMATIC CIRCUIT TESTER

The Lavoie "Robotester" LA-303 now being marketed in the United Kingdom by METRIX INSTRUMENTS, LTD., 54, Victoria Road, Surbiton, Surrey, is an automatic, tape programmed measuring instrument. Any two of 250 circuit points can be selected for measurement of resistance, polarised d.c. or a.c. voltage, insulation resistance, and impedance. The range of voltage measurements can be from 0·5 to 500 V. Insulation resistance is measured at 500 V d.c. with a 10,000 MΩ upper limit. The resistance range of the unit is from 1 Ω to 9·9 MΩ with a selected tolerance of 1, 5, 10 or 20 per cent of the nominal. Impedances in the range of 50 Ω to 100 kΩ are measured at programmed frequencies of 159 c/s, 1·59 kc/s or 15·9 kc/s. Between 60 and 100 tests per minute indicate wiring or assembly failures by flashing light indicators. Test results can be recorded with ancillary equipment.



Lavoie "Robotester" automatic circuit tester marketed by Metrix Instruments, Ltd.

ADHESIVE COATED COPPER FOIL

A range of printed circuit grade electrodeposited copper foil, coated with a dry thermosetting adhesive film, is announced by FOTHERGILL & HARVEY, LTD., Sladen Wood Mill, Littleborough, Lancs. The foil is produced in three weights: 1, 2 and 3 oz per sq ft. The thickness in mils (0·001in) of these is copper, 1·2-1·8, 2·5-3·5 and 3·8-5·1; adhesive, 1·4-1·6, 1·4-1·6 and 1·4-1·6, respectively; giving overall thicknesses of 2·6-3·4, 3·9-5·1 and 5·2-6·7. The foil is used in the manufacture of copper clad board for printed circuits. Depending on the base lamina and other factors, the range of press cycles that might be used covers temperatures from 285°F (140°C) to 350°F (177°C), times from 25 to 45 min, and pressures from 500 to 2,000 p.s.i.

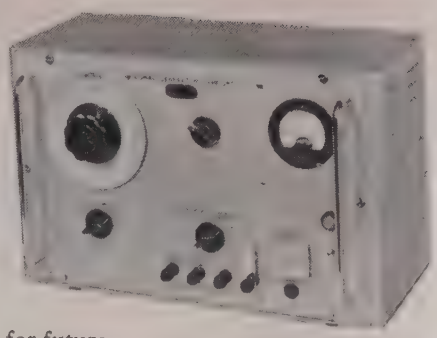
CEILING POINT OUTLET BOX

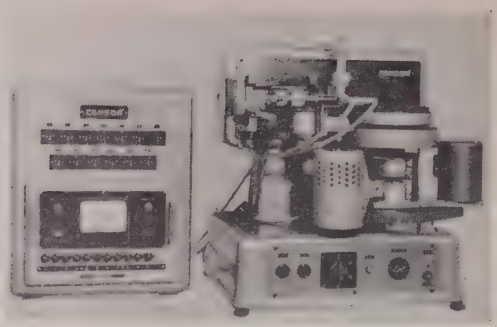
The S.L.R. ceiling point outlet box announced recently by RASHLEIGH PHIPPS & CO., LTD., Thackeray Street, London, W.8, is primarily intended to be used with mineral insulated copper covered cables of B.I.C.C. manufacture and to be installed on a grid or module basis on the soffit of floor slabs in commercial buildings.

The box is 4in square and ⅝in deep, manufactured in sheet steel and cadmium plated. It contains two 4-way removable 5 A shrouded connector units, two twin cable clamps and provision for the cable sealing glands to be accessible at all times without interfering with the ceiling finish. Various cover plates are available dependent on the fittings selected.

In designing an installation, it is intended that m.i.c.c. cable up to a maximum of a 4-core 0·0015 sq in shall

Airmec low frequency signal generator





Censor semiconductor wafer grading machine marketed by Engineering & Scientific Equipment, Ltd.

be used to afford spare cores for future switching modifications or circuit re-arrangement at any time in the life of the building. By using pre-formed factory assembled cable lengths fitted with sealing glands and tails, labour and the attendant risks of site assembly are minimised.

The finished ceiling plate is 4½in square and can either be shrouded by the fitting unit or adapted to take pendant suspensions. Generally, the box requires ⅝in finish, which can be either plaster or ceiling tiles on battens.

Because the unit is cadmium plated, continuity for earthing is automatically ensured as the saddle clamps are tightened up. The sealing pots are within the box and fully accessible without cutting away or making good, should a termination fault occur.

The cover plates have "kidney" shaped holes to give a final line-up of the plates on the ceiling to overcome any slight inaccuracy that may occur when initially fixing the box carcase.

LOW FREQUENCY SIGNAL GENERATOR

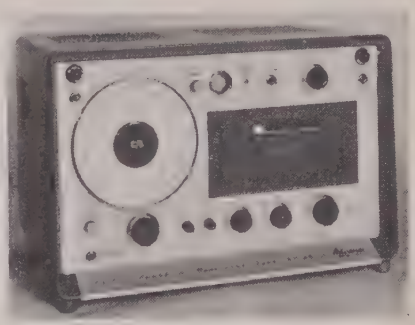
The l.f. signal generator type 252 produced by AIRMEC, LTD., High Wycombe, Bucks., is designed for the generation of pure and highly stable sine-wave signals in the frequency range 30 c/s to 300 kc/s. The oscillator consists of a Wien bridge network with thermistor feedback amplitude control, followed by a negative feedback push-pull amplifier; tuning is by a variable capacitor and covers the frequency band in four decade ranges with a calibration accuracy of ±1 per cent ±1 c/s. Long-term frequency stability is better than 0·1 per cent ±1 c/s over the frequency range, and stability with supply voltage variation is 0·02 per cent (approximately) at 1 kc/s for a variation of 10 per cent.

A screened and balanced output transformer provides either balanced or unbalanced outputs at an impedance of 600 Ω; circuit design is such that the output impedance remains constant regardless of frequency and attenuator setting, and the output is monitored by a crystal diode voltmeter. The output can readily be made fully floating by removing an external link on the front panel, and in this condition will withstand 300 V d.c. or peak a.c. to earth. An output control provides smooth variation of output over the meter range. In conjunction with a step attenuator, it enables the output level to be set to any value from less than 1 mV to 15 V open circuit with an accuracy of ±0·2 dB per step, ±0·3 dB overall. Output level variation over the whole frequency range of the instrument is approximately ±0·5 dB, rising to ±1 dB on the 0 dB attenuator setting with 600 Ω resistive load.

COMPLEX WAVEFORM GENERATOR

The v.l.f. function generator, SG.88, produced by ADVANCE COMPONENTS, LTD., Roebuck Road, Hainault, Ilford, Essex, is basically an optical/mechanical system. In this generator the conventional oscillator circuit is replaced by interchangeable transparent rotating discs, scanned by a narrow light beam. Printed on each disc is an opaque pattern representing in polar co-ordinates the wave-shape or function to be produced. The range of wave-shape is virtually limitless, requiring only that the function from which each is derived shall be single-valued and repetitive. The direction of rotation of the disc can be changed to reverse the time sequence of the output waveform.

The output frequency is continuously variable from 0·005 c/s up to a nominal maximum of 50 c/s. By increasing the number of complete patterns on the disc, the upper frequency limit can be increased to several times the nominal value. Acceleration of the disc on the two lower frequency ranges permits an almost instantaneous start from any pre-determined point of the waveform. The periphery of the disc is calibrated in degrees for this purpose. Sweep facilities are provided on the two upper frequency ranges to give rapid assessment of the response of the equipment under test. The frequency sweep commences at any pre-set frequency and proceeds logarithmically to the upper frequency limit of the



Advance Components complex waveform generator

range. Output voltage is from 200 μV to 20 V, peak-to-peak, high impedance, selected by a five-position decade multiplier and a continuously variable attenuator. The rectangular waveform rise-time varies from 300 msec at 0·005 c/s to 0·3 msec at 50 c/s. When an internal triggered device is switched in the rise-times are less than 5 μsec on all frequencies. Angular resolution of the optical system is 0·5° and the frequency response of the whole system is 0 to 3 kc/s. At maximum output, the output impedance is 300 to 3,000 Ω, depending on the frequency. The instrument can operate on 105-126 V or 190-252 V, 50-60 c/s, and the load rating is approximately 165 W.

SEMICONDUCTOR WAFER SORTING MACHINE

An instrument which tests and grades germanium and silicon wafers according to their thickness is produced by Censor of Liechtenstein and is now available in this country from ENGINEERING & SCIENTIFIC EQUIPMENT, LTD., Coronet House, 287/289, Old Street, London, E.C.1.

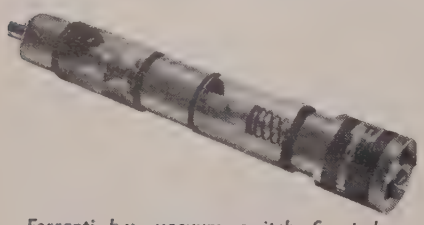
The machine can be employed for wafers having a diameter or side length between 1·0 and 3·5 mm and a thickness between 50 and 500 microns (0·05 to 0·5 mm). After a wafer has been placed on the gauging table by a suction pipette, the feeler

pin of a gauge head operating on the induction principle is lowered on to the wafer and the gauge head is connected to adjustable electronic switch devices for approximately $\frac{1}{100}$ sec by a pulse control. These switch devices subdivide the measurements of the gauge head into ten sorting and three extreme groups (samples too large, too small or adhering to one another), each of which, except the last group, has an associated signal lamp. The limits of the individual sorting groups can be infinitely varied between 1·0 and 20 microns.

The automatic sorting of the wafers is performed by the distributing unit, the rotary table of which carries receiving cups for the various sizes. A magnetic brake photoelectrically controlled by the current of the energised signal lamp stops the table in such a manner that a second suction pipette can deposit the checked wafer from the gauging table in the cup corresponding to its tolerance group. The wafers allocated to the various cups are counted. The capacity of the machine is up to 3,600 wafers per hour.

HIGH VOLTAGE VACUUM SWITCH

A vacuum switch designed primarily for high voltage pulse forming network switching in radar modulators is announced by FERRANTI, LTD., Dundee. The type 13VSB1 switch



Ferranti h.v. vacuum switch for pulse forming networks

comprises a glass and metal vacuum envelope containing two contacts—one fixed and the other movable—both of which are insulated from the earthy end to withstand a maximum pulse voltage of 15 kV. The moving contact is actuated by a solenoid against a spring load, which holds the contacts closed. The contacts move only about 0·020in.

Ratings for this "on-off" switch are:—Maximum pulse voltage 15 kV; maximum pulse current 100 A; d.c. test voltage 30 kV; operating time 5 msec maximum; contact resistance (closed position) 0·02 Ω maximum; capacity between contacts (open position) 1·5 pF maximum. The solenoid ratings are: 24 V d.c. supply; coil resistance 20 Ω ±10 per cent; pull-in current 1 A maximum; hold-in current 100 mA maximum. These ratings apply in ambient pressures down to 560 mm of mercury, and the switch is capable of withstanding the normal shock, vibration and centrifugal tests associated with unpressurised airborne electronic equipment. The vacuum dielectric ensures that accidental switching up to the full ratings will not result in permanent damage. The switch is 6in long overall, with a diameter of 1in and it weighs 6 oz.

SILVERED MICA CAPACITORS

Two more resin - encapsulated silvered mica capacitors in the "Silver Star" range are now available from JOHNSON, MATTHEY & Co., LTD., 73-83, Hatton Garden, London, E.C.1. These are the types C22E and C33E, both of which conform to Class H1 of the British Services' Climatic Specification, for working temperatures in the range −55 to +125°C. They are of rectangular section and have tinned phosphor-bronze leads emerging perpendicularly from the base. The leads are suitably spaced for 0·1 or 0·2in module printed circuit boards, and are sufficiently rigid to support the capacitors, but if vibration or acceleration forces in service are high, the capacitor can be cemented in place.

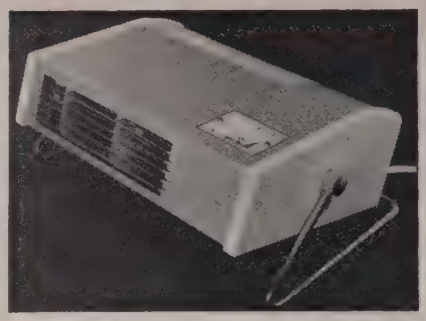
The type C22E has a base of 0·710in by 0·210in and is 0·450in high. The corresponding dimensions for the second unit are 1·130in by 0·315in by 0·625in. Both are available for peak working voltages of 200 and 350 V d.c. and the total capacitance range covered by the two types is 5-33,000 $\mu\mu$F, with a minimum tolerance of ±0·5 per cent, or ±1 $\mu\mu$F below 200 $\mu\mu$F.

MINIATURE ZENER REFERENCE ELEMENT

Hermetically sealed silicon zener reference elements for power supplies will provide voltage stability of ±1 per cent or better over temperatures from −55 to +100°C. Manufactured by the INTERNATIONAL RECTIFIER CO. (GT. BRITAIN), LTD., Hurst Green, Oxted, Surrey, the type 1N429 element has a 6·2 V operating voltage. Any number of these diodes may be used in series to obtain higher voltage reference levels. The diode is rated at 200 mW power dissipation at 25°C and has a maximum dynamic impedance of 20 Ω at 7·5 mA, and a power derating factor of 1 mW/°C. Units measure 0·330in by 0·230in diameter maximum, and have hermetically sealed, all-welded cases for resistance to humidity, corrosion and temperature extremes.

TURBO FAN HEATER

The "Record" turbo fan heater now being marketed by GEORGE W. BURGER, LTD., 63, St. Gabriel's Road, London, N.W.2, is of West German



"Record" turbo fan heater (George W. Burger, Ltd.)

construction and conforms to the appropriate British Standard Specifications. It is mounted on an adjustable stand and its overall measurements are 6in high by 12in long by 9in deep.

The fan heater is fitted with push-button control switches which provide cold air, warm (1 kW) or hot (2 kW). The finish is in grey and off-white and the price, including purchase tax, is £8 18s 6d.

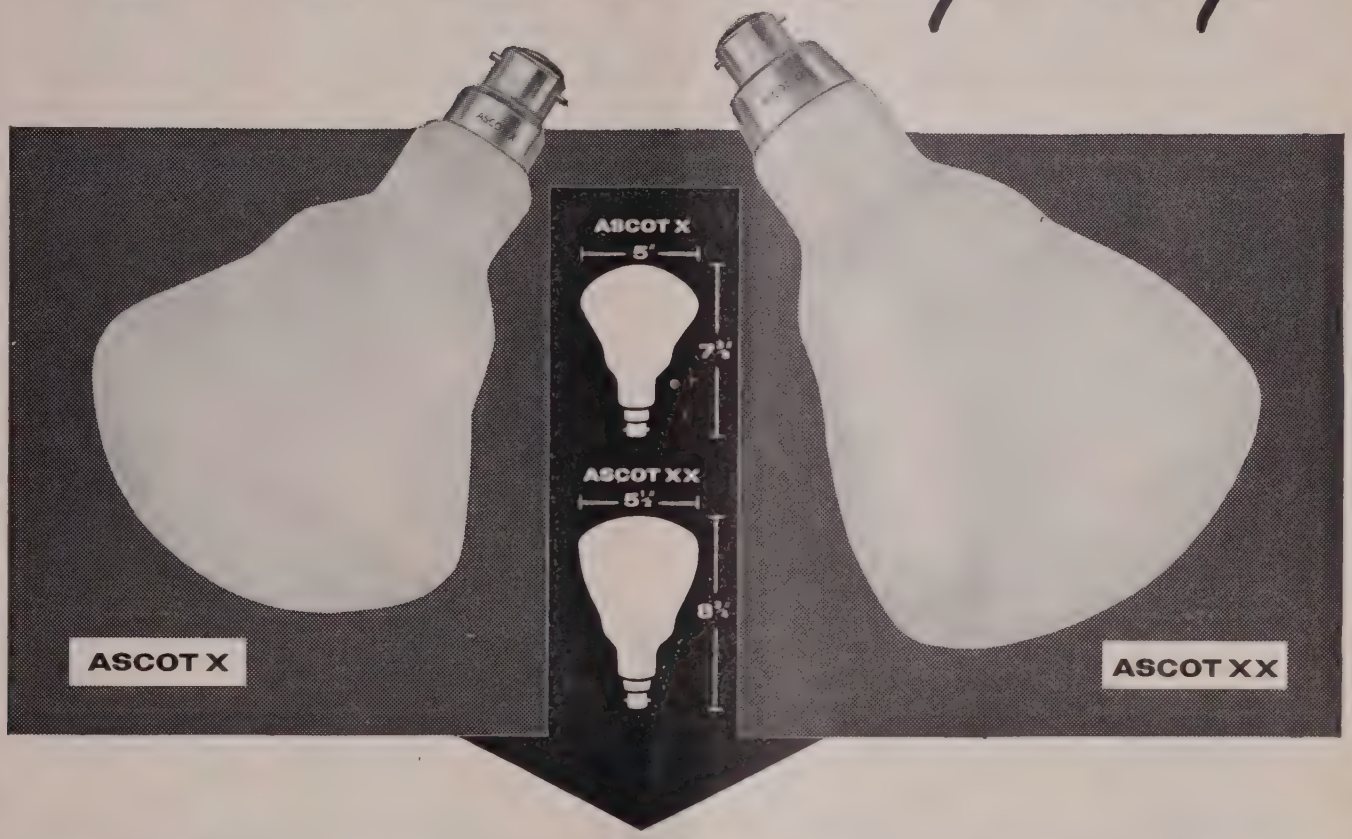
CLOTHES DRYER

The new "Mini-Dryer" clothes dryer shortly to be produced by A. J. FLATLEY, LTD., Irwell Bank Mills, Stoneclough, Radcliffe, Manchester, consists of a stove enamelled 1 kW heater, on gliders, on which is fitted a wooden collapsible rack. The heater measures 20½in long by 10½in wide by 9½in high and the total height of the rack when extended and placed on the heater is 43in. The clothes drying capacity is equivalent to 19ft of clothes line. The price, including purchase tax, is £2 19s 11d and production is expected to commence in October.



Flatley "Mini-Dryer" clothes dryer

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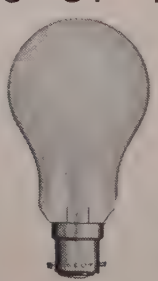
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SC/124

New Books

Industry and Careers. General editor, D. E. Wheatley. Pp. 872; illus. Iliffe Books, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 55s (postage 2s 6d).

To attempt in one volume to survey career opportunities in British industry is no mean task. Indeed, at first sight, it would appear to be well-nigh impossible to do more than produce a dull and uninspiring catalogue. The general editor of "Industry and Careers" has certainly avoided this pitfall in a very masterly fashion. The importance of this work is emphasised in a brief but pertinent foreword by Prince Philip who describes it as "a careful study" which will be "of great value to young people and their advisers."

There has undoubtedly been a great need for a comprehensive volume giving general guidance to the young man or woman who has sufficient interest to wish to choose to work in a particular branch and aspect of industry. The massive volume now produced will help such young people, although it must be admitted that a certain amount of determination will be required if anything other than very casual use is to be made of the 800 or so pages packed with information.

On the other hand there can be no doubt at all that those who are concerned with offering advice on the choice of careers (and this includes, or should include, parents) will find this work invaluable. For those who can spare the time it will well repay reading carefully before it is used as a reference book.

The introductory articles are well written and contain much valuable advice and information. One cannot help feeling, however, that the natural anxiety of one of the authors (J. G. W. Davies) to present a fair and unbiased account of day-to-day life in industry has led him to paint a picture which is, on the one hand, rather too gloomy and on the other does not do justice to the excitement and sense of achievement which can be experienced. To play a part as a member of a team in some new development or major project can give one a sense of satisfaction which is seldom obtained in other spheres. Some comment is also made on comparative working conditions, holidays and so on, but the man who puts long holidays and soft working conditions first is likely neither to be happy in industry nor accepted by it.

The main bulk of the book is, of course, concerned with descriptive matter covering a very wide range of different industries. The text is enlivened by good illustrations and informative diagrams.

In order to determine the usefulness of the individual sections one turns rather naturally to the one or two with which one is directly concerned. For example, the chapter on electrical engineering is found to be fairly comprehensive and provides a concise but reasonable survey of the size and scope of that branch of the industry together with an account of the types of firms involved and the main divisions of product. Education requirements and training facilities are well described and, perhaps most important of all, sources of further information are provided.

On balance one feels that a task of almost staggering magnitude has been very well undertaken and the result should prove to be of very great value. It is very much to be hoped also that this book will encourage more of the better brains from our schools and universities to accept the challenge that British industry offers. There should be no doubt in the minds of our young people that work in industry is not only interesting and rewarding but affords opportunity for real service to the community.
—S.E.G.

Modern Dielectric Materials. Edited by J. B. Birks. Pp. 253; figs. Heywood & Co., Ltd., Carlton House, Great Queen Street, London, W.C.2. Price 42s.

The last few years have seen rapid developments in the dielectric materials which are available to electrical engineers. It is seven years since the standard reference book on the subject was published under the editorship of von Hippel, and about half of the rather small number of references in the present book are after this date. Apart from the advantages of a relatively small book, some new materials such as the polypropylenes have now become available, as well as processes like the irradiation of polythene.

There are books published recently which cover a wide range of electrical engineering materials, including dielectrics, and on the other hand there are numerous papers on the subject, together with the critical reviews under the editorship of the editor of the present book. This book fills a gap between these two and provides an electrical engineer with a means of obtaining his first information on the properties of the wide range of new materials, and can then serve him as a reference book. There is no doubt of the need for more and more engineers to study these properties, so that they are ready to reap the advantages of new applications. One example from power engineering is switchgear where epoxy resins, fibreglass and nylon are contributing greatly to reduced cost and size.

Following an excellent brief introduction there are chapters by various specialists on paper (with a brief discussion on impregnated paper); hydrocarbon insulating oils and their non-inflammable rivals, the chlorinated hydrocarbons (askarels); natural and synthetic rubbers; plastics; silicones; ceramics; glass; mica and micanite; fibres and textiles. In each chapter the treatment and properties of each type of dielectric are given and space is not wasted by needless discussion of applications.

The editor has steered an excellent course between mere listing of properties and a too-highly-specialised theoretical work, so that the book can be freely read by those engineers who wish to increase their knowledge and by those who require information for immediate application.—A.E.G.

BOOKS RECEIVED

E.A.W. Electrical Handbook. 7th Edition. Prepared by the Electrical Association for Women. Pp. 312; figs. English Universities Press, Ltd., 102, Newgate Street, London, E.C.1. Price 15s.

Lead and Lead Alloys for Cable Sheathing. By S. A. Hiscock. Pp. 361; figs. Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4. Price 70s.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

SYNCHRONOUS machines are now widely used in industries where pulsating torques are required (e.g. piston compressors). These pulsating loads result in oscillations of the displacement angle θ and stator current, which should be kept within certain limits dictated by various considerations (voltage oscillations, strength of the insulation of the stator coils, losses).

For work with piston compressors, pulsations of the stator current corresponding to 66 per cent of the rated current are regarded as the limit of the permissible oscillations for synchronous motors. The only method of reducing the oscillations of a synchronous machine hitherto thought to be effective was an increase of its inertia mass. Naturally, this made the machine heavier and more expensive. Only recently a new method, viz. that of artificially damping the oscillations of a synchronous machine, was introduced; this consists in producing an additional electromagnetic torque on the shaft by injecting periodic currents into the rotor circuits.

Periodic currents are actually set up in the rotor circuits by the oscillations of the displacement angle θ. They may be represented by one component in phase with the displacement angle oscillations, yielding an additional synchronising torque, and another component in phase with the slip oscillations, yielding the asynchronous torque of the machine. To balance, or limit, the oscillations and to alter the frequency of the natural oscillations, it is necessary to alter from without the periodic components of the currents in the motor circuit in the desired sense. This can be achieved by introducing into the field circuit a periodic component of the external voltage of slip frequency, amplitude and phase of which can be varied arbitrarily.

The experiments carried out fully confirmed the possibility and the economic advantage of working with artificial damping for both synchronous motors and generators with a pulsating load on the shaft. The permissible extent of the reduction of the inertia mass can be determined by calculation and plotting of resonance curves for various values of the excitation.—" Artificial Damping in Large Synchronous Machines," by I. D. Urusov, L. N. Fedulov and V. F. Fedorov, *Elektrichestvo,* No. 7, pp. 13-18, 1961, in Russian.

Starting Torque of Capacitor Motors

Theoretical investigations were carried out concerning the short-circuit conditions of a capacitor motor with split-phase winding arrangement in the case where the capacitance was constant, but the transformation ratio ($\tilde{u}$) of the auxiliary and main windings was variable. It was shown that point S_o of the impedance diagram was particularly important, this being the point at which the perpendicular from the end point of the reactance vector X_c intersects the impedance vector. From the simple relationship $\tilde{u}_o = \sqrt{X_{sc} X_c \times Z_{sc}}$ three new equations for the starting torque are obtained; the first of these holds for any $\tilde{u}$, the second only for $\tilde{u}_o$ (providing at the same time a simple check of the calculations made) and the third determines the maximum starting torque. New formal relationships were also found for other design parameters, such as current and voltage of the auxiliary winding when $\tilde{u}=\tilde{u}_o$ and for any other value of $\tilde{u}$. The loci were investigated theoretically and numerically and the functional relationship between the absolute values of the other variables and $\tilde{u}$ was demonstrated with a numerical example, again yielding formal relationships for the extreme values. It was found, in contrast to conditions in polyphase induction motors, that the capacitor motor with constant capacitance yields, with high saturation (reduced turns number), a lower starting torque and, with lower saturation, a higher starting torque.—" Calculation of the Starting Torque of Capacitor Motors," by H. T. Berg, *Elektrotechn. Zeitschrift A,* Vol. 82, No. 16, 31st July, 1961, pp. 507-514, in German.

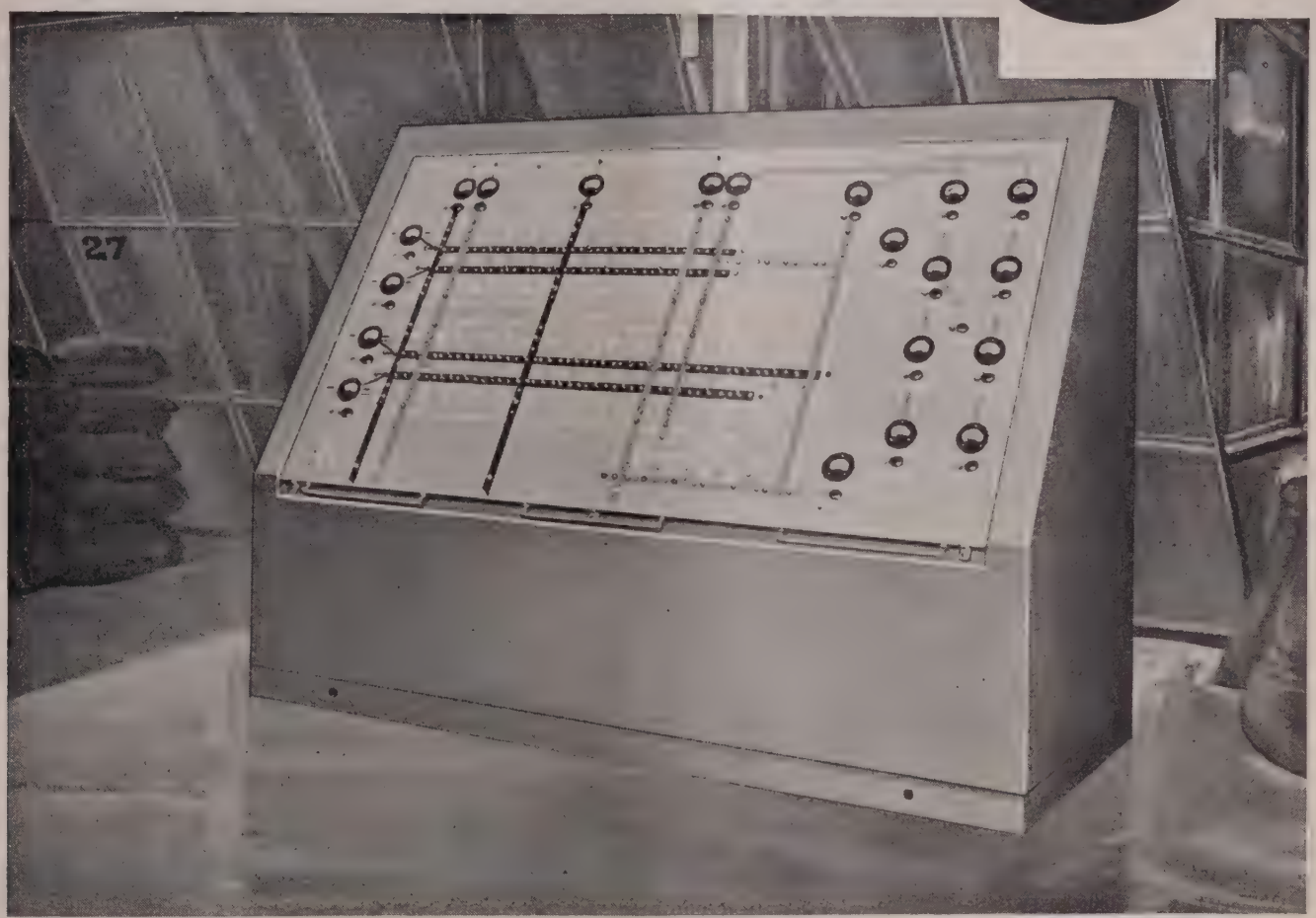
Excitation for Large Turbo-Generators

The growth of the electromagnetic loads of modern, large turbo-generators is accompanied by an increase of the transient and sub-transient reactances and reduction of the inertia constants of the rotors, both adversely affecting the stability of operation. The design of rotating exciters on the alternator shaft is complicated by difficulties of commutation; for this reason other types of exciters are being introduced. The comparative stability of large turbo-generators with different types of exciters was the subject of an electrodynamic model investigation.

The excitation systems studied were rotating and rectifier types, as well as power compounding. With the rotating exciter the recovery rate of the exciter voltage was 2 units/sec. The various types of rectifier systems were all supplied by the same six-phase circuit with interphase transformer and magnetic peak control. Only if 200-300 MW turbo-generators operate on relatively short lines can the usual transmitting capacity be assured under the normal conditions (t_{sc}=0·15-0·2 sec; k=2) without methods of improving the transient stability artificially. Since all the exciter systems investigated, except for " ionic " self-excitation without series transformers, furnished approximately the same results, the choice of the exciter systems for large turbo-generators depends mainly on technical and economic performance data and service characteristics.—" Effect of Excitation Systems on the Stability of Parallel Operation of Large Turbo-Generators," by V. M. Bobrov and G. R. Gertsenberg *et al,* *Elektrichestvo,* No. 7, pp. 7-13, 1961, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

Bulk Storage Control Panel by... MEM



The panel is designed to control a number of conveyors operating a bulk storage plant consisting of 33 bins of 7½ tons capacity each.

Each bin has a pneumatically operated slide controlled by a solenoid operated air valve, making it possible to route material from any intake position to any one of the bins.

The panel comprises contactors controlling the solenoid air valves and starters with ammeters for the conveyor motors, dust extractor, etc. Full electrical interlocking of the conveyors and various safety features have been incorporated in the control circuits.

The mimic diagram on the sloping front of the panel gives a clear indication of the state of the plant which extends over an eight storey building. The position of the 100 slides is shown by means of indicator lights. In the event of any dangerous condition arising, an alarm signal is sounded and visible warning is given by flashing lights showing the position of the blockage.

The circuit was developed in co-operation with Mr. G. S. Carr, A.M.I. Mech.E., A.M.I. Plant E., Chief Engineer of Messrs. Crosfields and Calthrop Ltd., manufacturers of animal and poultry foodstuffs.

MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD., TYSELEY, BIRMINGHAM, 11.

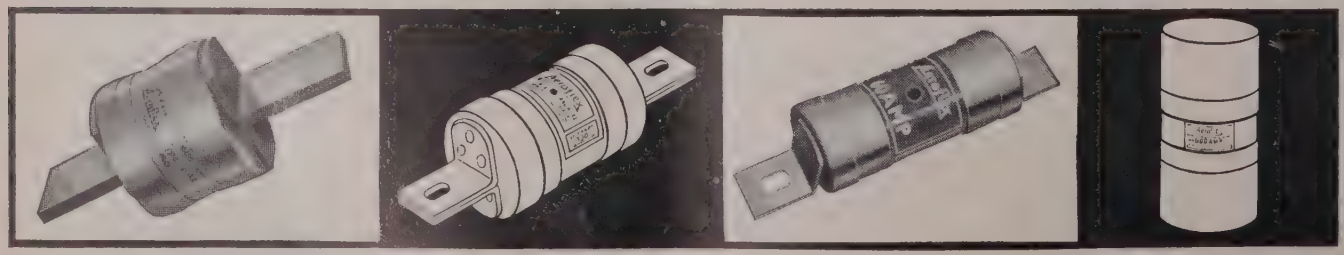


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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 11th SEPTEMBER

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Automatic Control Equipment for Small and Medium Oil-Burners," by L. G. Barnfield.

London.—White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. "History and Working of the Stock Exchange," by C. H. Dreyfus.

Wembley.—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. Discussion of "Home Heating Problems."

TUESDAY, 12th to FRIDAY, 15th SEPTEMBER

Manchester.—College of Science and Technology. Institution of Chemical Engineers. Course of lectures on "Pressure Vessel Design."

TUESDAY, 12th SEPTEMBER

Chester.—Blossoms Hotel, 7.45 p.m. A.S.E.E. Chester and District Branch. Ladies' meeting.

Edinburgh.—25, Charlotte Square, 7.30 p.m. Institution of Plant Engineers, Edinburgh Branch. Members' evening.

Farnborough.—Queen's Hotel, 8 p.m. A.S.E.E. Aldershot and Districts Branch. "Swedish Supply and Hot-Line Working," by A. Flude.

Gloucester.—Royal Hotel, Station Road, 8 p.m. A.S.E.E. Gloucester and District Centre. "The Panelec Warming System."

Leicester.—Westcotes Constitutional Club, 124, Wilberforce Road, 7.30 p.m. A.S.E.E. Leicester Branch. Chairman's address.

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Guest speaker, Sir William Cook.

Manchester.—Engineers' Club, Albert Square. Institution of Plant Engineers, Manchester Branch. Chairman's "At Home."

WEDNESDAY, 13th SEPTEMBER

Birmingham.—Engineering and Building Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Diesel-electric Propulsion for Trains," by J. L. Aspland.

Exeter.—Royal Clarence Hotel, 7 p.m. Institution of Plant Engineers, Western Branch. Film "Hinkley Point Power Station."

Loughborough.—College, 10 a.m. Society of Instrument Technology, East Midland Section. Conference on "Application of Instrumentation to Industrial Processes."

Luton.—College of Technology, Park Square, 8.15 p.m. A.S.E.E. Luton Branch. "A Short History of the A.S.E.E.", by W. J. Wheeler, and film "120,000 kW under the Sea."

Norfolk.—Red Lion Hotel, Thetford, 7.30 p.m. A.S.E.E. East Anglia (Thetford) Centre. "The Protection of Electrical Installations," by J. A. Robbins.

Portsmouth.—Royal Air Force Association Club, Cosham, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. Film night.

Wolverhampton.—Chamber of Commerce, District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. "Static Switching Control Systems," by B. A. W. Midgley.

THURSDAY, 14th SEPTEMBER

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch. "Lighting in Home and Industry," by J. W. Howell. (Postponed from 7th September.)

Chelmsford.—Social Club, Hoffmann Manufacturing Co., Ltd., 7.30 p.m. Institution of Mechanical Engineers, Lubrication and Wear Group. "Lubricants in Nuclear Reactors," by P. E. B. Vaile.

Glasgow.—Scottish Building Centre, 425, Sauchiehall Street, C.2, 7.15 p.m. Institution of Plant Engineers, Glasgow Branch. "Electronic Control of Machine Tools and Production Plant."

Liverpool.—Merseyside and North Wales Electricity Board Industrial Centre, Paradise Street, 7 p.m. Society of Instrument Technology, Liverpool Section. Address by chairman on "Instruments in the Phosphate Industry."

London.—Prince of Wales Hotel, S.W.19, 8 p.m. A.S.E.E South West London Branch. "Unearthing London," by N. Cook.

Newcastle-on-Tyne.—Roadway House, Oxford Street, 7 p.m. Institution of Plant Engineers, North East Branch. "Insurance and the Plant Engineer," by J. H. Oswald.

Nottingham.—People's College of Further Education, Castle Road, 7.30 p.m. A.S.E.E. Nottingham Branch. Chairman's address.

FRIDAY, 15th SEPTEMBER

Hanley.—Grand Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Electronic Controls and Photo-electric Equipment," by G. I. G. Ive.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated.

23rd September

Loblite Prismalite. No. B805,346. Class 11. Bulkhead fittings.—Loblite, Ltd., Third Avenue, Team Valley, Gateshead-on-Tyne.

Isopad. No. 818,393. Electric heating apparatus included in Class 11.—Isopad, Ltd., Isopad House, Barnet By-Pass, Boreham Wood, Herts.

Fanfare. No. 821,920. Class 11. Cabinets for drying clothes.—Aerialite, Ltd., Castle Works, Stalybridge, Ches.

30th September

Epeo. No. B807,275. Class 7. Washing and drying machines, food mixing and electrically operated juice-extracting machines. B807,274. Class 9. Radio, telegraphic, television, telephonic, telecommunication, etc., apparatus; vacuum cleaners, flat irons; and floor polishing, waxing and scrubbing machines, all electrically operated and for domestic use. No. B807,276. Class 11. Refrigerators, electric toasters, electric cookers; heating apparatus, hair-drying apparatus, and electric fans.—N.V. Philips' Gloeilampenfabrieken, Eindhoven, Holland. Address for service: T. D. Threadgold, Century House, Shaftesbury Avenue, London, W.C.2.

Frigeco. No. 819,229. Class 7. Washing and ironing machines.—Frigeco S.A., France. Address for service: Baron & Warren, 16, Kensington Square, London, W.8.

Carbox. No. 795,457. Class 9. Electric cells, electric batteries, and electrolysis apparatus and instruments.—National Research Development Corporation, Tilney Street, London, W.1.

Quenchrod. No. B810,917. Class 9. Electrodes for electric welding.—Eutectic Welding Alloys Co., Ltd., 40-42, Copthall Avenue, London, E.C.2.

A-B (design). No. B813,001. Class 9. Electric battery charging apparatus; electrical control apparatus; electrical instruments for varying the potential of electric currents; and automatic electric switches, grid leaks, potentiometers, condensers and rheostats.—Allen-Bradley Company, U.S.A. Address for service: Frank B. Dehn & Co., Imperial House, 15-19, Kingsway, W.C.2.

Wee Cons. No. 819,861. Class 9. Electrical condensers.—Erie Resistor, Ltd., Millora Works, Beevor Road, South Denes, Great Yarmouth.

SGS (design). No. B815,654. Class 9. Semiconductors, diodes, transistors, resistors, inductors, condensers, magnetic cores, electronic tubes and printed circuits.—Societa Generale Semiconduttori S.p.A., Italy. Address for service: Cruikshank & Fairweather, 29, St. Vincent Place, Glasgow, C.1.

AMP (design). No. 815,988. Class 9. Capacitors, electrical pulse-forming networks, and boards fitted with means for plugging-in and securing electrical contacts and conductors.—Amp Inc., U.S.A. Address for service: Urquhart-Dykes & Lord, Maxwell House, 11, Arundel Street, Strand, London, W.C.2.

Magnethermic. No. B798,623. Class 11. Electric induction furnaces (not for experimental purposes).—Ajax Magnethermic Corporation, U.S.A. Address for service: Lloyd Wise, Bouly & Haig, 10, New Court, Lincoln's Inn, London, W.C.2.

Duofric. No. 819,318. Class 11. Refrigerators.—Siemens-Electrogerate Akt.-Ges., Germany. Address for service: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

Catalogues and Lists

CONDUIT FITTINGS.—Trade price list covering conduit, conduit fittings and wiring sundries.—**General Electric Co., Ltd.**, Four Ashes, Wolverhampton.

CONTROL GEAR.—Brochure (E.252) dealing with industrial reversing and midget type controllers, cam operated master controllers and armchair controls for cranes.—**E.M.B. Co., Ltd.**, West Bromwich.

COUNTERS.—Pamphlet giving information on fully-transistorised photo-electric counters.—**Tyer & Co., Ltd.**, Perram Works, Merrow Siding, Guildford, Surrey.

LAMP MAKING MACHINERY.—Illustrated booklet describing lamp making machinery for incandescent and fluorescent lamps and machinery for the manufacture of semiconductors.—**Bader Machinery Co., Ltd.**, Walton-on-Thames.

PRECIPITATORS.—Brochure (87) containing 20 pages describing the principle of electrical precipitation and its practical application to dust control problems in industry.—**W. C. Holmes & Co., Ltd.**, Turnbridge, Huddersfield.

RELAY.—Data sheet on the "Sonotek" ultrasonic relay designed to provide proximity protection in conditions unfavourable to capacitive relays.—**Elcontrol, Ltd.**, Wilbury Way, Hitchin, Herts.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets have remained very subdued while awaiting a lead from developments arising out of the new economic policies at home and the increase of tension in foreign affairs. Prices have held fairly steady, with the gilt-edged market looking perhaps a little firmer than the industrial sections. Sir Edward Wilshaw's recent comments on the relative attractions of the two markets in today's circumstances, from the point of view of investment trust funds, have been widely quoted, and may have contributed towards a further modest improvement in Government stocks. Among industrials, yield considerations were thought to have been the main factor in a better demand for the shares of the major electrical groups. English Electric and G.E.C. both give returns in the neighbourhood of 6½ per cent, while A.E.I. offer nearly 8 per cent.

Quiet Markets

In A.E.I. and G.E.C. shares the improvement in prices over the week extended respectively to 3s and 2s 9d, and these were among the few changes of any consequence to be recorded in the electrical lists. British Electronic Industries, however, staged a good recovery to 11s; the first results of the Pye-Ekco merger may be expected to be published before long. A. F. Bulgin (at their best price of the year), Chloride Electrical Storage, Metal Industries and I.C.T. also showed up comparatively well. Among recent issues, there was some activity in Ether Langham Thompson new shares at a premium of around 8s 3d on the offered price of 10s, and Carbon Electric Holdings were steady at 3s 6d. Electric Construction recovered to 22s 9d on consideration of the chairman's report on current business.

Dividends Declared

In view of the very confident assessment of Strand Electric's prospects in last year's report, with particular reference to the company's interests in the television field, expectations of good figures in the accounts for 1960–61 had been running high, and they were not disappointed by the preliminary statement of a 57 per cent improvement in profits and a rise in the dividend from the equivalent of 12⅔ to 20 per cent, as forecast last April. A much larger tax charge reduces the increase in the net surplus to 17 per cent, but the distribution is still well on the conservative side. The yield on the 5s shares, which were unchanged at 18s, goes up to 5½ per cent. Christy Bros. 5s shares have been marked up by some 4s, to 23s 9d, since the announcement of doubled profits and an increase in the dividend from 8 to 10 per cent.

Bid for Cossor

Shareholders of A. C. Cossor have now received the formal offer of 7s 9d

Price Changes in

Company or Board	Nom. Value	Middle price 4th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1961 Highest	1961 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	71	+⅛	3	3	4 4 6	75⅛	70⅛
Brit. Elec. 1974/77	100	66	+⅛	3	3	4 11 0	70⅛	64⅛
Brit. Elec. 1976/79	100	68⅛	+⅛	3⅛	3⅛	5 2 3	73⅛	67
Brit. Elec. 1974/79	100	75⅛	+⅛	4⅛	4⅛	5 12 6	82	75
Brit. Elec. 1967/69	100	87	+⅛	4⅛	4⅛	5 3 6	91⅛	86
Overseas Electric Supply								
Calcutta Elec.	£1	21/-		7†	7⅛†	11 12 0	23/3	20/6
East African Power	£1	13/6		8	10	14 16 6	15/-	13/-
Nigerian Elec.	£1	18/6		8	10	11 2 0	19/9	15/6
Perak Hydro-Elec.	£1	21/3		10	10	9 8 3	23/6	17/6
Electrical Shares								
Aberdare Holdings	5/-	15/-		17½	17½	5 16 9	17/-	14/3
Aerialite	1/-	4/9		54	54	11 7 0	8/-	4/6
Allen, W. H.	£1	30/-		14	10*	6 13 3	42/6	30/-
Allied Insulators	5/-	8/-		20	10*	6 5 0	10/-	8/-
Alwyn Holdings	5/-	19/6	+6d	12½	15‡*	3 17 0	22/3	16/6
Anglo-Portuguese Tel.	£1	20/-		9	9	9 0 0	25/-	18/9
Arcolectric	1/-	4/9	−3d	15	15	3 3 3	6/-	3/9
Aron Meters	5/-	20/-		15	15	3 15 0	20/-	17/-
Assoc. Elec. Ind. Ord.	£1	38/-	+3/-	15	15	7 18 0	48/6	35/-
Automatic Tel. & El.	5/-	16/3		17	17	—	20/6	12/9
Babcock & Wilcox	£1	26/9	+3d	9	9	6 14 6	36/6	25/6
Bakelite	10/-	45/-		17½	17½*	3 17 9	60/-	42/-
Baldwin, H. J.	2/-	1/3		10	Nil	—	1/9	1/3
Berry's Electric	5/-	52/3	+1/3	30	33⅓*	3 3 9	52/6	37/-
Bowthorpe Holdings	2/-	7/9		18⅓	22	5 13 6	10/3	7/9
Brit. Elec. Resistance	2/-	7/-		17½	17½*‡	5 0 0	8/9	6/6
Brit. Elec. Traction: Def. Ord. "A"	5/-	48/6		40	50	5 4 3	57/6	41/9
Brit. Electronic Ind.	5/-	11/-	+1/-	—	15‡	6 16 3	15/3	8/9
B.I. Callender's	£1	57/9		13⅛	13⅛	4 13 6	62/3	49/6
B.I. Callender's 6% Pref.	£1	16/6		6	6	7 5 6	18/3	16/6
British Thermostat	5/-	30/-		20	27½	4 11 9	40/-	28/-
Brook Motors	10/-	53/-		25	25*	4 14 3	55/-	47/-
Bulgin, A. F.	1/-	12/3	+1/-	55	40*	3 5 3	12/3	7/9
Bulpitts	5/-	17/9		15	16½	4 11 6	27/6	16/9
Burco Dean	5/-	6/3		18	15	12 0 0	11/9	6/3
Cable & Wireless	5/-	16/9	−3d	10	10*‡	2 19 9	19/9	12/6
Cambridge Instruments	5/-	32/-		12½†	22	3 8 9	38/6	30/-
Chloride El. Storage "A"	£1	82/6	+1/9	17½	20	4 17 0	91/-	72/-
Clarke Chapman	£1	37/6		13¾	13¾	7 6 9	54/-	37/6
Clarke, T.	2/-	4/-		16	16	5 6 9*	5/3	3/6
Combined Elec. Mfrs.	4/-	6/9		—	12½	7 8 3	10/-	6/9
Contactor Switchgear	5/-	12/9		14	14	5 9 9	16/-	12/9
Cossor, A. C.	5/-	7/3		Nil	Nil	—	8/-	5/6
Crabtree	10/-	24/6		20	12½*	5 2 0	33/9	24/6
Crompton Parkinson	5/-	12/-		14	12½*	5 4 3	14/6	11/3
De La Rue	10/-	51/-	−6d	22½	22½*	4 8 3	70/-	51/-
Decca "A"	10/-	60/6	−1/-	20	23⅓	3 17 0	70/-	52/3
Desoutter	5/-	55/-		30	35	3 3 9	68/9	49/-
Dewhurst	2/-	4/6	−3d	20	20	4 9 0*	6/6	3/9
Dictograph Tel.	2/-	10/-	+3d	20	20*	4 0 0	13/-	8/6
Dimplex	5/-	76/3	−1/3	—	30	1 12 9*	83/9	47/-
Dubilier Condenser	1/-	2/-		30	15*	7 10 0	3/-	2/-
Duport	5/-	11/-		17⅛	20	6 1 3*	17/-	11/-
E.M.I.	10/-	36/9	−6d	20	17⅛*	4 15 3	51/3	36/9
Eleco	2/-	8/-		20	20*‡	5 0 0	10/6	4/3
Electrical Apparatus	5/-	18/-	−6d	14⅛	20	5 11 0	21/-	17/-
Electrical Components	5/-	7/9		11⅛	12½	8 1 3	9/9	7/9
Elec. Construction	£1	22/6	+1/9	9	5	4 9 0	39/-	20/3
Elliott-Automation	5/-	35/-		9·3	13	1 17 3	37/6	25/6
Enfield Rolling Mills	£1	39/6	−6d	15	15	7 12 0	51/6	39/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

in cash for each 5s ordinary share, and par for the 6 per cent preference shares, from the American company Raytheon. In the light of the accompanying statement on the company's position it is thought unlikely in the market that they will have much difficulty in making up their minds to follow their directors' advice to accept it. For the year ended last month, it is disclosed, there was a group loss of £443,000. Matters have improved lately to the extent that a small profit is anticipated in the current year, but it is pointed out that a number of years must pass before the clearing of the heavy debit balance permits a resumption of dividends.

Electrical Investments

Company or Board	Nom. Value	Middle price 4th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1961 Highest	1961 Lowest
Electrical Shares—continued						£ s d		
English Electric	£1	30/6	+9d	10	10	6 11 3	40/9	29/9
English Electric 3¾% Pref.	£1	10/-		3¾	3¾	7 10 0	11/9	10/-
Ericsson	5/-	27/3	−6d	13†	13†	—	32/-	22/3
Ever Ready	5/-	37/6	+9d	20	22½	3 0 0	40/-	31/6
Falk Stadelmann	£1	22/6		10	7½	6 13 3	26/-	21/9
G.E.C.	£1	31/6	+2/9	10	10	6 7 0	39/6	28/9
G.E.C. 6½% Pref.	£1	16/6		6½	6½	7 17 6	19/3	16/6
General Cables	5/-	5/3		15	Nil	—	6/3	5/9
G.H.P. Group	£1	21/-	−6d	6	7‡	6 13 3	24/6	17/-
Goblin (B.V.C.)	5/-	4/6		12½	10	11 2 0	8/6	4/3
Hackbridge Holdings	5/-	6/-x.d.	+1/3	20	10*	8 6 9	6/9	5/-
Harland Engineering	5/-	13/3		16	16	6 0 9	19/-	13/3
Head Wrightson	5/-	23/6		14	16	3 8 0	30/-	22/-
Heatrae	2/-	13/9	−3d	12½	25	3 12 9	19/-	12/6
Holophane	5/-	16/-		26	30	9 7 6	20/6	16/-
Hoover	5/-	40/-		90	45*	5 12 6	55/6	37/6
Hunt, A. H.	4/-	18/9		20	20	4 5 3	25/9	18/-
Intl. Combustion	5/-	25/-	−6d	30	30	6 0 0	33/9	24/-
Intl. Computers & T.	£1	93/9	+1/3	10	11½	2 8 0	107/-	59/-
Johnson & Phillips	£1	20/9	−3d	Nil	5	4 16 6	24/-	17/6
Kenwood Mfg.	1/-	4/-		—	—	—	6/-	4/-
Laurence Scott	5/-	14/3		15	15	5 5 3	18/9	14/3
Lister, R. A.	£1	51/-	+6d	14	14	5 9 9	56/9	45/6
Lucas, J.	£1	52/6	−6d	12½	13¾	5 4 9	71/6	52/6
Marryat & Scott	2/-	16/9		27½	32½	3 17 6	18/6	13/9
Mather & Platt	£1	37/6	−6d	11	11	5 17 0	51/6	37/6
Metal Industries	£1	56/-	+1/-	15	15	5 7 3	66/6	50/-
Midland Elec. Mfg.	£1	58/9	−1/3	12	12	4 1 9	67/6	58/6
Murex	£1	41/3		20	13*	6 6 3	51/6	39/3
Newman Ind.	2/-	7/-		12½	15	4 5 9	7/6	5/-
Oldham & Son	1/-	2/9		17½	17½*	6 7 3	3/-	2/3
Parsons, C. A.	£1	51/3	−1/3	9⅜	12½	4 17 6	72/6	46/9
Philips' Lamps	Fl.10	200/-		16	16*	1 12 0	£13¼	£9¾
Plessey	10/-	48/9	−6d	17	15*‡	4 2 0*	60/-	46/6
Pullin Group	2/-	11/6		25	25	4 7 0	15/-	11/3
Pyrotenax	5/-	55/-		40	45	4 1 9	65/-	46/6
Radiation	£1	23/6	−1/6	12	10	8 10 3	37/6	23/6
Reliance-Clifton	5/-	28/6		15	20	3 10 3	32/6	22/6
Reyrolle	£1	41/3	−9d	17½	9¾*	4 14 6	51/6	36/6
Richardsons Westgarth	10/-	4/6		8½	Nil	—	8/3	4/6
Sangamo Weston	10/-	18/9	−9d	12½	13½	5 6 9*	25/9	18/9
Scott, James	5/-	30/-		25	27½	4 11 9	32/-	25/6
Simon Engineering	5/-	36/3		—	27½	3 15 9	43/9	28/-
Smith (England), S.	4/-	14/9	−6d	17½	20	5 8 6	23/9	14/6
Southern Areas	£1	16/6		5	6	7 5 6	23/-	14/6
Strand Elec.	5/-	18/-		14·6	20	5 11 0	20/-	12/3
Sturtevant	5/-	11/-		15†	13†	9 14 0	18/6	11/-
Sun Elec.	5/-	15/6		15	18½	5 19 0	17/6	15/6
T.C.C.	10/-	41/3	−9d	35	22½*	5 9 0	43/9	40/-
Telephone Rentals	5/-	24/9	+1/-	15	15‡*	3 0 6	29/6	18/6
Thompson (John)	5/-	13/9		20	5	—	16/9	13/9
Thorn Elec.	5/-	51/3		25	25	2 8 9	63/-	44/6
Thornycroft	4/-	5/6		6	6	—	7/-	5/6
Tube Investments	£1	62/-	−6d	—	14	4 10 3	85/-	62/-
Ultra Electric	5/-	25/-		20	25	—	31/3	12/6
Walsall Conduits	4/-	10/9	−3d	15	15	5 11 6	15/-	10/9
Ward & Goldstone	5/-	28/9		35	17½*	3 0 9	36/6	25/6
Watford	2/-	7/-		25	20*	5 14 3	10/9	7/-
Westinghouse	£1	32/-	−1/9	11	11	6 17 6	45/-	32/-
West, Allen	5/-	11/-		12½	13½	6 2 6	14/6	10/3
Wilkins & Mitchell	5/-	8/9		21	12	6 17 3	15/3	8/9
Wolf Electric	5/-	13/6		12½	13¾	5 1 9	17/6	13/6

Ultra Electric

Fundamental changes introduced during the present year into the business of Ultra Electric (Holdings) have made it difficult for the market to assess prospects for the company's 5s shares, but the fact that at 25s they are worth double the price ruling at the start of the year shows the conclusions to have been of a generally favourable nature. In a recent statement from the chairman, shareholders were given a summary of information about the reasons for the sale of the radio and television business to Thorn Electrical for about £2·4 million, and for the establishment of the link between American interests and the Ultra Electronics subsidiary, in which the parent retains now an interest of 60 per cent: this is evidently to be the base upon which the future of Ultra Electric is to be built.

Dividend Prospects

With considerable financial resources available now for investment in the programme of research and development on which the expansion of Ultra Electronics is planned, and with the advantages of the American association, the chairman of the parent company looked forward, in his statement, to steady growth. At this stage, he made no forecast of dividends. Earnings of the Electronics subsidiary were said in May to be running at an annual rate in excess of £400,000, and the parent's 60 per cent share of this would fall short of the amount required to maintain the dividend at the 25 per cent rate paid for 1960–61. Mr. Rosen believed, however, that it would not be very long before the holding company's 60 per cent interest developed a value substantially larger than the 100 per cent share held previously.

Hackbridge Dividend

Early this year Hackbridge Holdings reduced the interim dividend on account of the twelve months to last March from the equivalent of 3¾ to 2½ per cent, so that the directors' decision to make good the deficiency in the final distribution, leaving the total unchanged in effect at 10 per cent, came as an agreeable surprise to the market. According to the preliminary statement, group trading profits improved from £160,000 to £177,000 (before tax). There is now a yield of 8¼ per cent on the 5s shares, which were marked up by 1s 3d to 6s ex-dividend after the announcement.

REPORTS and DIVIDENDS

Electrical Components (Holdings), Ltd.—During the year to 31st March, 1961, the radio section of the business suffered a very sharp decline, but the chairman, Mr. L. S. Seccombe, says sales of transistor radios proved a bright spot. It was on the electrical side as a whole, and in the wiring section in particular, where the greater part of the business is done, that most progress was made. In general, the current year's sales have been maintained for three months, with small increases in certain areas.

Telephone Manufacturing Co., Ltd.—A group net profit of £78,220 for the 15 months ended 31st March, compared with a loss of £1,059 in the previous year, is announced by the company, now a subsidiary of Pye, Ltd. A dividend of 5 per cent (the same) is proposed for the six months from 1st October, 1960, the date of acquisition by Pye.

Oldham & Son, Ltd.—In reporting that direct exports now absorb 25 per cent of the company's production, Mr. John Oldham, the chairman, adds a warning that the fight to maintain the company's present export level, let alone increase it, is going to be much more severe. He believes that increasing diversification of the company's production will broaden the base of sales in the export field. Overseas subsidiaries have made encouraging progress. Mr. Oldham has "measured confidence" in the company's ability to meet the challenge of the future.

Bids for Clydesdale Withdrawn.—The board of Craibstone Investments, Ltd., has withdrawn the proposed offer of 6s in the £ to unsecured creditors of the Clydesdale Supply Co., Ltd. Earlier last week creditors had been told, at separate meetings, which were adjourned until 8th September, that a bid of 7s 6d in the £ had been withdrawn by an unnamed London group and that Craibstone had increased its bid by 1s to 6s.

Strand Electric Holdings, Ltd., is paying a final dividend of 12 per cent to make an increased total for the year of 20 per cent. Group net profit in the year to 30th April, 1960, increased to £68,302 from £56,677 after allowing for a higher tax charge.

Britannia Electric Lamp Works, Ltd.—The dividend for the year to 31st March last is being raised from 12½ to 15 per cent. Group net profit increased from £25,117 to £28,381, after tax of £27,362 (£20,911). The amount attributable to the holding company is £25,423 (£22,653).

Midland Electric Manufacturing Co., Ltd.—Interim dividend 4 per cent (the same).

Walsall Conduits, Ltd.—Interim dividend unchanged at 5 per cent.

New Companies

Amalgamated Electric Services, Ltd.—Registered 14th July. Capital £1,000. Service and maintenance engineers and repairers and manufacturers of and dealers in radio and television receivers, etc. The subscribers are: Philips Electrical Industries, Ltd. (999 shares) and R. A. P. Burrill. Solicitors: Bird & Bird, 2, Gray's Inn Square, W.C.1.

Aylesbury Automation, Ltd.—Registered 14th July. Capital £1,000. To design and develop electrical, electronic, chemical and mechanical devices of all kinds for the production, handling, inspection, testing and assembling of manufactured products. Solicitors: Linklaters & Paines, 59/67, Gresham Street, E.C.2.

Crossley-Premier Electrics, Ltd.—Registered 19th July. Capital £1,000. Regd. office: Mark Street, Sandiacre, Nottingham.

Chas. E. Price, Ltd.—Registered 18th July. Capital £10,000. Electrical and refrigeration engineers, etc. Directors: C. E. Price and Muriel Price. Regd. office: 28, Market Street, Hoylake, Ches.

Haydn Williams, Ltd.—Registered 21st August. Capital £100. Electrical engineers, etc. Directors: H. C. Williams and Mrs. Rita J. Williams. Secretary: D. S. Coleman. Regd. office: 28, Longbridge Avenue, Saltdean, Sussex.

Milady Electrical Appliances, Ltd.—Registered 17th August. Capital £1,000. Directors: H. Morris, I. Morris and L. D. Morris (secretary). Regd. office: 186, Greengate, Salford, 3.

N. Goswell, Ltd.—Registered 17th August. Capital £100. Manufacturers of and dealers in electrical goods, etc. L. A. Watson is the first director. Secretary: Brenda O. Love. Regd. office: 8, The Crescent, Minories, E.C.3.

S.G.T. Electrics (Lancing), Ltd.—Registered 17th August. Capital £200. Directors: R. E. Petitt, Mrs. Daisy Monnery (secretary), P. R. Thurston and A. W. Evans. Regd. office: Commerce Chambers, Commerce House, South Street, Lancing, Sussex.

J. H. E. Litchfield, Ltd.—Registered 2nd August. Capital £2,000. To acquire the business of electrician and electrical contractor carried on by J. H. E. Litchfield at Warwick, etc. Directors: J. H. E. Litchfield and Patricia R. Litchfield (secretary). Regd. office: 95, West Street, Warwick.

Winding-Up Petitions

Sheppard Electronics, Ltd.—A petition for the winding-up of the company has been presented to the High Court and is to be heard on 9th October. Anyone intending to appear should notify Samuel Tonkin & Co., 3, Berners Street, London, W.1, not later than 6th October.

Domestic Refrigeration Co., Ltd.—A petition for the winding-up of the company has been presented in the High Court and is to be heard on 9th October. Anyone who intends to appear at the hearing should notify A. W. Coleman & Allibone, 20, Kingsway, London, W.C.2, by 6th October.

Warden Electrics, Ltd.—A petition for the winding-up of the company has been presented in the High Court and is to be heard on 9th October. Anyone wishing to appear should notify Cochrane & Cripwell, 119, Finsbury Pavement, London, E.C.2, by 6th October.

Liquidations

Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.

Lithgow Electronics, Ltd. (Members' voluntary winding-up).—Meeting of members at Bartlett House, 9-12, Basinghall Street, London, E.C.2, on 22nd September to receive an account of the winding-up from the liquidator, Mr. S. J. Chubb.

Better Housekeeping Appliances (Southampton), Ltd., 432a, Bitterne Road, Bitterne, Southampton, electrical appliance dealers.—Liquidator, Mr. G. E. Radford, 12, Portland Street, Southampton, appointed 6th July with a committee of inspection.

Thornley Electrical, Ltd., radio and television dealers, 3, Manor Place, Sunderland, Co. Durham.—Winding up voluntarily. Liquidator, Mr. A. J. Gray, of the above address, appointed by creditors on 15th August.

Phipps & Culling (Products), Ltd., 43, High Street, Addlestone, Surrey, dealers in electrical appliances.—Liquidator, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, Sussex, appointed 17th August with a committee of inspection.

William J. Hook & Co., Ltd., electrical engineers, 45, Green Lanes, Palmers Green, London, N.13.—Winding up voluntarily. Liquidator, Mr. M. G. R. Keeling, of the above address, appointed by members on 26th August.

Peto Scott Electrical Instruments, Ltd., Weybridge Trading Estate, Addlestone Road, Weybridge, Surrey, radio, television and electrical manufacturers.—Third dividend, 2s 6d in the £, payable 15th September at the offices of W. H. Cork, Gully & Co., 19, Eastcheap, London, E.C.3.

Bankruptcies

P. R. Morrison and **G. D. J. Williams,** formerly carrying on business in partnership under the style of P.G. Electrics at 17, Winston Square, Colcot, Barry, Glam., and 50, Queenshill, Newport, Mon., household electrical appliance retailers.—Public examination 13th October at the County Court, Westgate Street, Cardiff.

D. Boulton and **L. C. Turner,** lately carrying on business in partnership under the name of Derek Boulton at Old Town Avenue, Plymouth, radio and electrical engineers (Joint estate).—Supplemental dividend of 7¾d in the £ payable at the Official Receiver's Office, 1st Floor, Royal Building, St. Andrew's Cross, Plymouth.

E. C. Johnson and **J. A. Sheward,** carrying on business in co-partnership under the style of Edstan Electric at 20, Market Street, Hanley, Stoke-on-Trent, and 40, London Road, Newcastle-under-Lyme, Staffs., electrical contractors.—Last day for receiving proofs for dividend today (Friday). Trustee, Mr. W. H. Meredith, 12, Lonsdale Street, Stoke-on-Trent.

H. Smith, lately carrying on business as an electrical engineer at the Old Bakery, South Clifton, Notts.—Supplemental dividend of 6d in the £ payable 14th September at 185, High Street, Lincoln.

F. Mielniczek, dealer in domestic electrical equipment, 261, Eversholt Street, London, N.W.1.—Receiving order made 9th August on a creditor's petition. Public examination 10th November at Bankruptcy Buildings, Carey Street, London, W.C.2.

S. Lixenberg, 4, Forburg Road, Stamford Hill, London, N.16, electrical contractor.—Receiving order made 16th August on a creditor's petition.

complete interchangeability with 'MUTAC CLIPPER'





G.E.C. Installation Equipment Group have a *new approach* to designing switches. Now you can fit any of the 11 interchangeable 'Mutac Clipper' switch units into just 3 different sizes of grids and boxes . . . for example, 3 switch units into a standard BS 1299 or plaster depth box. G.E.C.'s new approach makes 'Mutac Clipper' switches unrivalled for ease and speed of assembly . . . ensures that these precision-made, electronically-tested switches give a *guaranteed* long-life performance . . . takes the clicking out of switching.

Interchangeable switch units:

5 amp 1 way S.P.
15 amp 1 way S.P.
5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
Neon Indicator
Blanking Unit

'Mutac Clipper' switches cost no more than ordinary switches to buy and far less to install—that's a result of G.E.C.'s *new approach.*

Complete interchangeability of 'Mutac Clipper' enables you to standardise right through a job.

that's the New Approach of G.E.C.

INSTALLATION EQUIPMENT GROUP

IMMEDIATE DELIVERY *of all 'Mutac Clipper' switches from wholesalers throughout the country. If you would like more detailed information ask your wholesaler for 'Mutac Clipper' literature.*

'HIDUTAC' switchfuses remain operative after 120,000 operations at 1½ times full tungsten lighting load



Type tests prove that 'Hidutac' switchfuses will interrupt their full load current with unfailing reliability—just one of many 'Hidutac' exclusive features resulting from the *new approach* of the G.E.C. Installation Equipment Group to switchgear design. The *new approach* has crystallised from G.E.C.'s many years' experience of making switchgear superbly well.

Consider these other impressive advantages: *High breaking capacity*—8 times the rated full load current—through cam-operated, double-break, silver contacts. *Total internal enclosure* of all moving parts, with shields over live terminals. *High fault-current protection* in Single Pole and Neutral, Double Pole, Triple Pole, Triple Pole and Neutral switchfuses with H.R.C. or rewirable fuses. Categories of duty are:—H.R.C. fuses, all ratings, AC4 of BS88 (33000 amp); rewirable fuses, 15 and 30 amp ratings, S2A of BS3036 (2000 amp); rewirable fuses, 60 amp rating, S4A of BS3036 (4000 amp). *Modern styling* of pressed steel case with fully interlocked cover.

These exclusive features make 'Hidutac' switchfuses vastly superior for tungsten and discharge lighting control, motor, and transformer and capacitor switching.

IMMEDIATE DELIVERY of 'Hidutac' switchfuses from wholesalers throughout the country. For more detailed information ask your wholesaler for 'Hidutac' literature.



that's the New Approach of G.E.C.

INSTALLATION EQUIPMENT GROUP

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1956

24359. Electric & Musical Industries, Ltd.—Gas-filled discharge lamps. 9th August, 1957. (876084.)

1957

508. English Electric Co., Ltd.—Nuclear reactors. 2nd January, 1958. (876232.)

3475. British Oxygen Co., Ltd.—Method and apparatus for electric arc cutting. 21st January, 1958. (Addition to 872726.) (876068.)

18699. Associated Electrical Industries, Ltd.—Operating circuits for electromagnetic relays and such like electromagnetically operable devices. 28th April, 1958. (876322.)

29080. Philips Electrical Industries, Ltd. —Permanent magnets. 16th September, 1957. (876291.)

29853. A. Reyrolle & Co., Ltd.—Arc control devices for high voltage oil circuit-breakers. 19th December, 1958. (876242.)

30080. International Computers & Tabulators, Ltd.—Transistor circuits. 13th August, 1958. (876368.)

31013. Minneapolis-Honeywell Regulator Co.—Manufacture of transistors. 3rd October, 1957. (876326.)

37118. Philips Electrical Industries, Ltd. —Transistor circuit arrangements for demodulating and amplifying signals. 28th November, 1957. (876042.)

38517/8. Metallwerk Plansee G.m.b.H.—Fuel elements for nuclear reactors. 11th December, 1957. (876399 and 876021.)

1958

788. Associated Electrical Industries, Ltd. —Electrical power circuits. 3rd February, 1959. (876179.) 1042. Electrical socket contacts. 9th January, 1959. (876056.) 1357. Manufacture of thermionic valve grids. 14th January, 1959. (876329.) 1890. Electrical plug-in type contact pins. 20th January, 1959. (876057.)

2131. Douce, J. L., and West, J. C.—Electric signal generators. 15th January, 1959. (876292.)

2458. Standard Telephones & Cables, Ltd.—High power semiconductor rectifiers. 24th January, 1958. (876133.)

2621. Rendar Instruments, Ltd.—Electrical connector devices. 26th January, 1959. (876293.)

5550. General Electric Co., Ltd.—Manufacture of thermo-electric devices. 13th February, 1959. (876294.)

6279. Siemens & Halske A.G.—P-n-p-n type semiconductor devices. 26th February, 1958. (876400.)

6854. Bosch G.m.b.H., Robert.—Self-sealing electric condensers. 4th March, 1958. (876119.)

7304. Associated Electrical Industries, Ltd.—Thermionic valve grids. 24th February, 1959. (Cognate application 25393.) (876406.)

13793. Junghans A.G., Geb.—Synchronous motor clocks. 30th April, 1958. (876375.)

14111. Associated Electrical Industries, Ltd.—Electrode structures for electron-discharge devices. 26th March, 1959. (876295.)

15601. Plessey Co., Ltd.—Electrostatic precipitators and apparatus for detecting the presence of radioactive particles in a gas stream. 15th May, 1959. (875991.)

16830. Fernseh G.m.b.H.—Circuit arrangements for the measurement of peak voltages. 27th May, 1958. (876356.)

18011. Associated Electrical Industries, Ltd.—Holders for electrical components. 1st June, 1959. (876357.)

18516. Kabelwerk Oberspree Veb.—Process and means for increasing the bending strength in cable cores in the terminals of oil-filled high tension cables. 10th June, 1958. (876296.)

19313. Plessey Co., Ltd.—Equipment for monitoring radioactivity in liquids. 16th June, 1959. (876237.)

20170. Plessey Co., Ltd.—Apparatus for measuring the total activity discharged from a radioactive fluid disposal plant. 16th June, 1959. (876238.)

26816. Associated Electrical Industries, Ltd.—Control equipment for nuclear reactors. 20th August, 1959. (876028.)

26949. English Electric Valve Co., Ltd.—Germanium wafer rectifier units. 15th May, 1959. (876358.)

29467. General Electric Co., Ltd.—Colour television receivers. 31st August, 1959. (876239.)

33207. Esso Research & Engineering Co. —Moving bed nuclear reactor for process irradiation. 17th October, 1958. (876401.)

35009. General Electric Co., Ltd.—Colour television receivers. 5th October, 1959. (875876.)

36574. British Oxygen Co., Ltd.—Electric arc welding. 2nd November, 1959. (876379.)

39020. British Insulated Callender's Cables, Ltd.—Electric cable joints. 2nd December, 1959. (875521.) 29021/2. Electric connectors. 2nd December, 1959. (875522/3.) 39023. Housings for electric cable joints. 2nd December, 1959. (875524.)

41775. Sylvania Electric Products, Inc. —Lamp inspection apparatus. 24th December, 1958. (876267.)

41779. Rolls-Royce, Ltd.—Electric remote control apparatus. 17th December, 1959. (876346.)

1959

863. Hart, W. R.—Dry shaving appliances. 11th January, 1960. (876245.)

1944. Associated Electrical Industries, Ltd.—Mass spectrometers. 14th January, 1960. (876247.)

1999. John Davis & Son (Derby), Ltd., and Davis, W. B.—Coupling devices for electrical conductors. 23rd March, 1960. (876269.)

2188. Santon, Ltd.—Water heaters. 21st January, 1960. (876383.)

3846. Associated Electrical Industries, Ltd.—Cable connectors. 3rd February, 1959. (876348.)

6378. Pirelli-General Cable Works, Ltd.—Electric cables. 10th December, 1959. (876361.)

7133. Pirelli-General Cable Works, Ltd. —Electric butt-joint seam welding. 21st December, 1959. (876352.)

7154. General Electric Co., Ltd.—Electric heating means. 5th February, 1960. (876362.)

10065. Sperry Rand Corporation.—Dry shavers. 14th August, 1959. (Addition to 809702.) (876251.)

11522. Busch-Jaeger Dürener Metallwerke A.G.—Electrical fan heating devices. 6th April, 1959. (876270.)

22366. Joseph Lucas (Industries), Ltd.—Rheostats. 30th June, 1960. (876978.)

23004. Kaiser, J., and Mayer, F.—Electric flow heaters. 3rd July, 1959. (876825.)

23322. Texas Instrument, Inc.—Semiconductor assemblies. 7th July, 1959. (876468.)

24487. Dixon & Co., Ltd., R. G.—Floor or like suction cleaning implements. 20th April, 1960. (Cognate application 37129.) (876277.)

27539. Westinghouse Electric Corporation.—Arc welding apparatus. 12th August, 1959. (876864.)

28006. Ryder, E. D.—Electrical immersion heating boiler for central heating and the like. 17th August, 1959. (875707.)

28529. Associated Electrical Industries, Ltd.—Suction cleaners. 26th May, 1960. (876411.)

28615. Grace & Co., W. R.—Plate separator for storage batteries. 21st August, 1959. (876389.)

29117. Siemens-Schuckertwerke A.G.—Method of sheathing an electric cable in which the insulation is impregnated. 25th August, 1959. (876412.)

29252. Siemens-Schuckertwerke A.G.—Processes for use in the production of impregnated electric cables. 26th August, 1959. (875905.)

29348. Siemens & Halske A.G.—Semiconductor devices and methods of producing such devices. 27th August, 1959. (876332.)

30343. Foxboro Co.—Electrical to mechanical magnetic transducer. 4th September, 1959. (875434.)

31405. General Electric Co.—Apparatus for the direct conversion of thermal to electrical energy. 15th September, 1959. (Addition to 854036.) (876318.)

32631. Seele, H. A.—Electromagnetic relay. 25th September, 1959. (876334.)

35454. Westinghouse Electric Corporation.—Undervoltage sensing circuits. 20th October, 1959. (876415.)

39784. Allmänna Svenska Elektriska A.B. —Gas-blast electric circuit-breakers. 24th November, 1959. (875968.)

40688. A. Reyrolle & Co., Ltd.—Electric protective devices of the spark-gap type. 30th November, 1959. (876866.)

40902. Western Electric Co., Inc.—Radio telephone communication system. 2nd December, 1959. (Addition to 793991.) (876752.)

44383. Amp, Inc.—Method of, and apparatus for, stripping a sheath from an electrical conductor. 31st December, 1959. (876108.)

1960

310. Allmänna Svenska Elektriska A.B.—Insulation tester for low voltage installations. 5th January, 1960. (876303.)

327. General Motors Corporation.—Cam-operable electric switches. 5th January, 1960. (876336.)

338. Sperry Rand Corporation.—Electric dry shavers. 5th January, 1960. (876252.)

578. Westinghouse Electric Corporation. —Thermo-electric devices. 7th January, 1960. (876337.)

7756. Westinghouse Electric Corporation. —Preparation of semiconductor devices. 4th March, 1960. (876340.)

14801. British Telecommunications Research, Ltd.—Electrical signalling systems. 27th April, 1960. (Addition to 864442.) (876305.)

10501. Smidth & Co. A.S., F.L.—Electro-vibrators. 24th March, 1960. (876950.)

15205. Bendix Corporation.—Electron multipliers. 29th April, 1960. (876472.)

15374. Bendix Corporation.—Semiconductor device. 2nd May, 1960. (876077.)

18035. Union Carbide Corporation.—Electric cells. 23rd May, 1960. (875977.)

19568. Minnesota Mining & Manufacturing Co.—Thermo-electric generators. 2nd June, 1960. (876130.)

21243. Hoover, Ltd.—Suction cleaners. 16th June, 1960. (876112.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Australia.—New South Wales Electricity Commission. 23rd October. 66 kV underground connection between overhead line terminations and switchyard. (E.S.B. 28204/61.)*

Overseas Telecommunications Commission (Australia), Sydney. 3rd November. Telex exchange, switching and recording equipments. (E.S.B. 27607/61.)*

Hydro-Electric Commission, Tasmania. 25th September. 530 time switches. (E.S.B. 27618/61.)*

Burma.—Government Purchase Board. 18th September. Electric lamps. (E.S.B. 27675/61.)* Electrodes. (E.S.B. 27674/61.)* 20th September. Auto-transformer starters. (E.S.B. 27670/61.)* Distribution board and switches. (E.S.B. 27668/61.)*

Ceylon.—Tender Board, Ministry of Agriculture, Land, Irrigation and Power. 17th October. Aluminium conductors. (E.S.B. 27397/61.)*

Egypt.—Cairo Electricity and Gas Administration. 5th October. Transmission lines. (E.S.B. 27344/61.)*

Ministry of Public Works, Cairo. 1st October. Four floating pumping stations. (E.S.B. 27686/61.)*

Formosa.—Central Trust of China. 18th September. Pulse generator. (E.S.B. 27662/61.)* 20th September. Wattmeters. (E.S.B. 27663/61.)* 16th October. 4,320 kW silicon rectifier with transformer, switching equipment and spare parts. (E.S.B. 27606/61.)*

Ghana.—Ghana Supply Commission. 4th October. 1·1, 3·3 and 11 kV cables. (E.S.B. 27601/61.)*

Greece.—Ministry of National Defence. 26th September. Transformers. (E.S.B. 27034/61.)*

India.—Assam State Electricity Board. 7th October. Lightning arrestors, 33 and 11 kV air-break switches, cable, etc. (E.S.B. 28246/61.)*

Damodar Valley Corporation. 27th December. 125-140 MW turbo-generator units for Durgapur and/or Chandrapura power stations. (E.S.B. 27394/61.)*

Inverurie.—Burgh Council. 2nd October. Re-lighting trunk road A.96. (See Classified Advertisement Section.)

Iraq.—Ministry of Municipalities. 23rd September. Cable accessories. (E.S.B. 27942/61.)* Overhead line equipment. (E.S.B. 27933/61.)*

Kuwait.—Department of Electricity, Water and Gas. 18th October. Cable and accessories. (E.S.B. 28255/61.)*

Manchester.—City Council. 18th September. Electrical installation in clinic at Withington. (See Classified Advertisement Section.)

Neath.—R.D.C. 2nd October. Street lighting installation. (See Classified Advertisement Section.)

New Zealand.—Auckland Electric Power Board. 13th October. Four 12 MVA transformers. (E.S.B. 27396/61.)*

Nigeria.—Electricity Corporation of Nigeria. 18th September. 540 three-phase, four-wire electricity meters. (E.S.B. 27324/61.)*

Pakistan.—W.A.P.D.A., Lahore. 30th September. Cable accessories. (E.S.B. 27368/61.)* 2nd October. Aluminium conductor. (E.S.B. 27369/61.)* Batteries and trickle charging sets. (E.S.B. 27971/61.)* 3rd October. Disc insulators. (E.S.B. 27371/61.)* A.c.s.r. conductor. (E.S.B. 27370/61.)*

Peru.—Departmento de Ingenieria de la Corpac, Edificio ex-PIA, Limatambo, Lima. 6th November. Airfield projects, including lighting, telecommunication installation and lifts. (E.S.B. 27398/61.)*

Portuguese East Africa.—Ports, Railways and Transport Department. 13th October. Electrical equipment. (E.S.B. 27968/61.)*

Slough.—Corporation. 5th October. Electrical installation work at Cippenham Sewage Disposal Works. (See Classified Advertisement Section.)

Syria.—Communications, Posts, Telephones and Telegraphs Administration. 25th October. Telephone sets and switchboards. (E.S.B. 27632/61.)*

Thailand.—State Railways. 3rd October. 175-200 kW diesel engine generator set and motor-driven air compressor. (E.S.B. 27994/61.)*

Trinidad.—Trinidad and Tobago Electricity Commission. 16th October. Insulators, insulator pins, stay wire, cross-arms, etc. (E.S.B. 27902-12/61.)*

Turkey.—N.A.T.O. Infrastructure Contract. Transmitters and receivers. Notification of wish to tender not later than 18th October. (G.D. 157/60(35).)†

United States.—Bureau of Reclamation. 28th September. Three outdoor power transformers. (E.S.B. 28210/61.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Andover.—Factory extensions; Riley & Neate, Ltd., Anton Mill Road.

Houses (48), Vigo estate; H. C. Janes, Ltd., Vigo Road.

Aylesbury.—Factory; Nestlé Co., Ltd., St. George's House, Wood Street, London, E.C.2.

Barnet.—Houses (83), Bells Hill estate; McManus & Co., Ltd., Mimms Hall Road, Potters Bar.

Birmingham.—Factory, Bullock Street; B. & E. Products, Ltd., 207, High Street, Aston.

Bristol.—Works and offices, Dale Street and Frome Street; Beaverbrook Newspapers, Ltd., Fleet Street, E.C.4.

Cardiff.—Extensions to Atlantic College; Sir Percy Thomas & Son, architects, 10, Cathedral Road.

Chatham.—Two-storey office block, 195-203, New Road; D. A. Fuller, 168, New Road.

Christchurch.—Extensions to laundry at Christchurch Hospital (£59,700); Galloway & Partners, architects, 10, Portland Street, Southampton.

Dagenham.—Extensions to municipal premises, including three-storey office block; borough surveyor, Civic Centre.

Eastbourne.—Four-storey office block, 1/5, Ivy Terrace; Jackson & Greenen, architects, Hinton Buildings, Hinton Road, Bournemouth.

Factory, Brampton Road trading estate; R. J. Bedford, Ltd., Minster Works, York Road.

Edinburgh. — Electronic data-processing centre, Bankhead Causeway North (£200,000); National Coal Board, 1, Eglington Crescent, Edinburgh, 12.

Havant.—Health clinic, community centre and ambulance station (Phase II), Leigh Park; county architect, Winchester.

Hebburn (Co. Durham).—Bungalows (102), communal hall and proposed swimming baths for the R.D.C.; R. C. Bestow, surveyor.

Hoddesdon.—Factory; Morleys, Ltd., Regina Works, Birmingham, 12.

Liverpool.—Neurosurgical unit, Walton Hospital; Regional Hospital Board Architects' Department, 55, Castle Street.

Flats (176), Harding Street; director of housing, Blackburn Chambers, Dale Street, Kingsway.

London.—Extensions to laboratories and students' hostels, Medical College of St. Bartholomew's Hospital, Charterhouse Square; Easton & Robertson, architects, 53, Bedford Square, London, W.C.1.

Nine-storey block of flats, Stoke Newington; Hurst, Pierce & Malcolm, consulting engineers, Artillery House, Artillery Row, S.W.1.

Mexborough.—New factory (£200,000); Alexandre, Ltd., Cardigan Crescent, Kirkstall Road, Leeds.

Oxford.—First stage of nuclear science research centre, Keble Road; Ove Arup & Partners, consulting engineers, 8, Fitzroy Street, London, W.1.

Plymouth.—Office block; Phœnix Assurance Co., Ltd., St. Andrew Square.

Sedgley.—Works, Holloway Street; Hermit Industries, Ltd., 21, Hermit Street.

Smethwick.—Library and block of flats, Price Street shopping centre; borough engineer, Council House.

South Shields. — Factory for Industrial Estates Management Corporation; Cotton, Ballard & Blow, architects, 48, Pilgrim Street, Newcastle-on-Tyne.

Sunderland.—Factory, North Hylton Road, for Hepworth & Grandage, Ltd., Bradford; Geo. Wimpey & Co., Ltd., Elswick Road, Newcastle-on-Tyne.

Surbiton.—Central library extension; R. W. Eglinton, arhitect, 20a, Eden Street, Kingston-on-Thames.

Timperley.—Central College of Further Education; Ronald S. Biggins & Associates, architects, Richmond Place, Boughton, Chester.

Tonyrefail.—Factory extension; Worcester Industrial Ceramics, Ltd., Gilfach Road.

Uxbridge.—Factory; Mogron Engineering, Ltd., Norwich Union House, Bakers Road.

Wallington. — Central library extension; Robert Atkinson & Partners, architects, 13, Manchester Square, London, W.1.

Walsall.—Erection of the West Midlands Teachers' Training College (£600.000); director of education, Darwall street, Walsall.

Works, Fryers Road, Bloxwich; Lander & Partners, Ltd., Littleton Street East.

Wheatley.—Teachers' Training College for Bucks. E.C.; county architect, County Hall, Aylesbury.

Winchester.—Hotel on site near the Cathedral for Trust Houses, Ltd.; Fielden & Mawson, architects, 71a, The Close, Norwich.

Windsor.—Multi-storey flats, St. Leonard's Hill; James Miller & Partners, Ltd., 7, Suffolk Street, London, S.W.1.

Witchford.—Second instalment of secondary school for Isle of Ely C.C.; Ambrose & Son, Ely, Cambs.

Worksop.—Houses (30), Valley Road estate; borough engineer, Park House.

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* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.

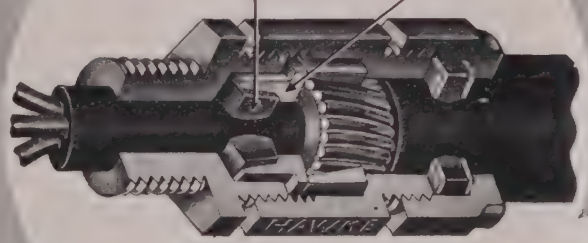
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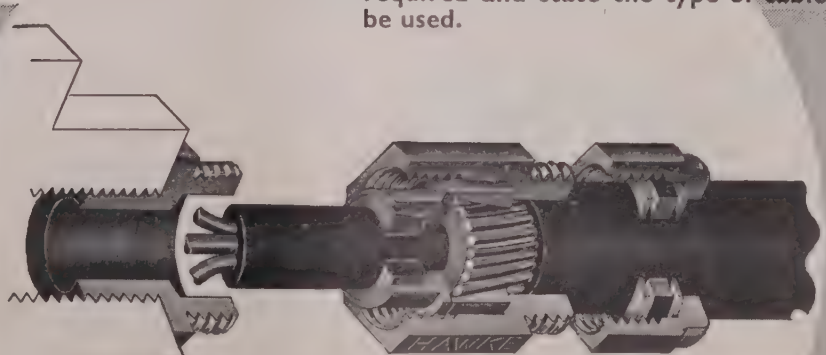
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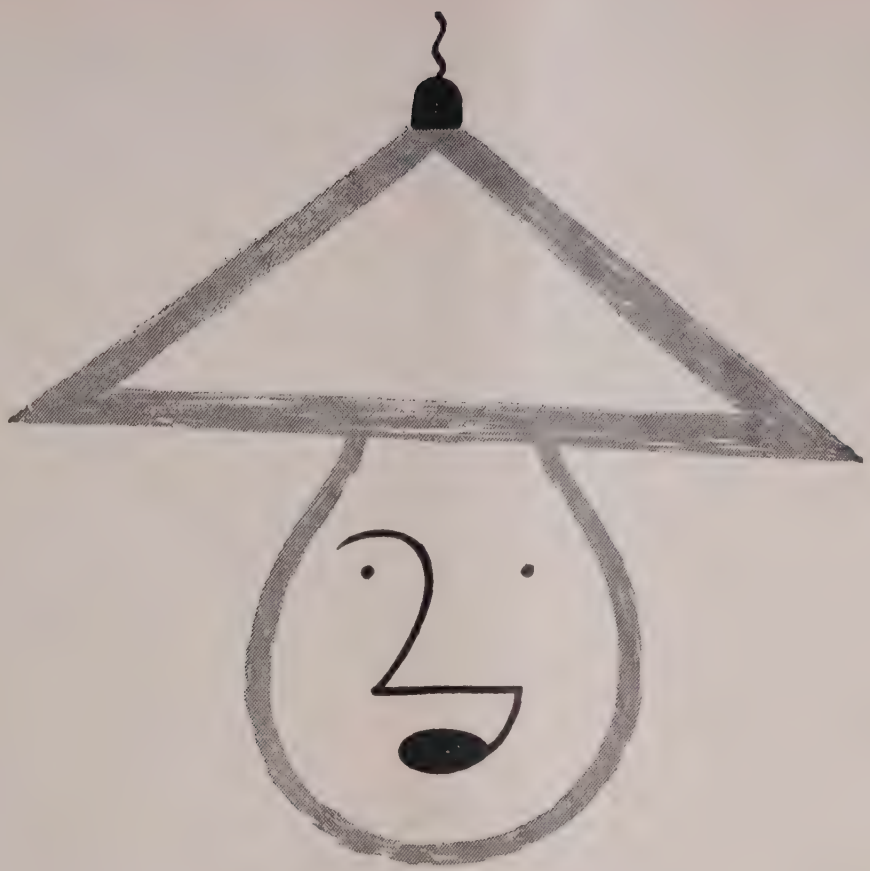
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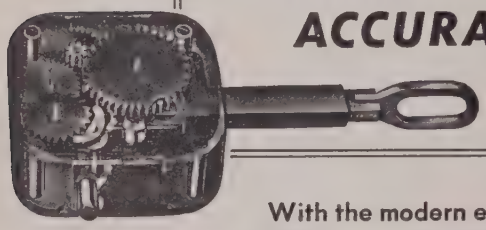
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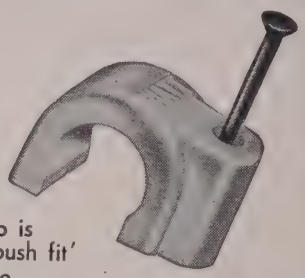
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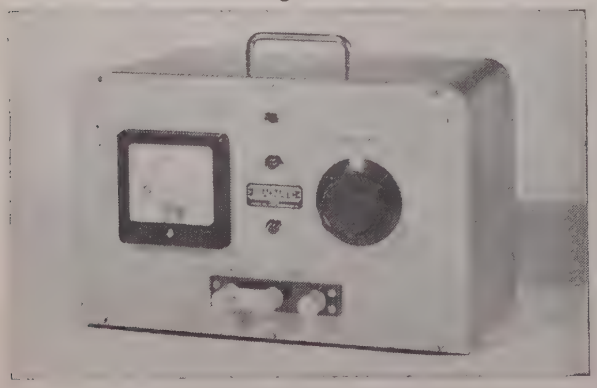
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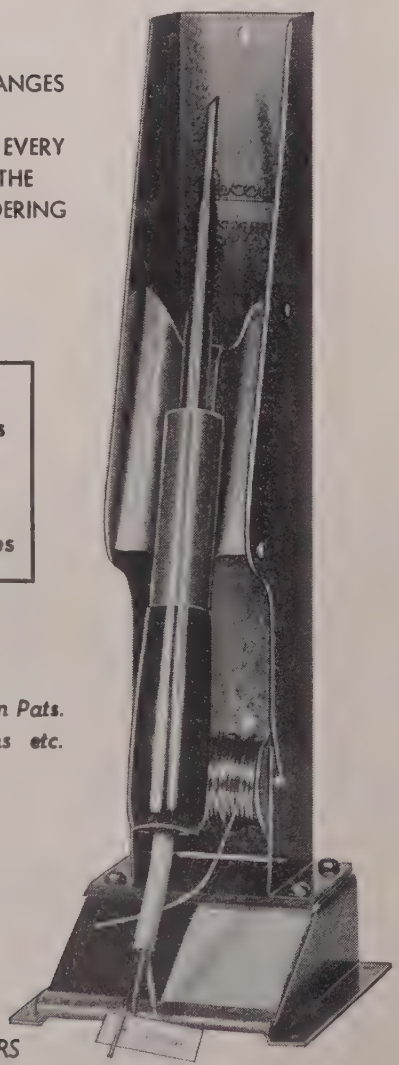
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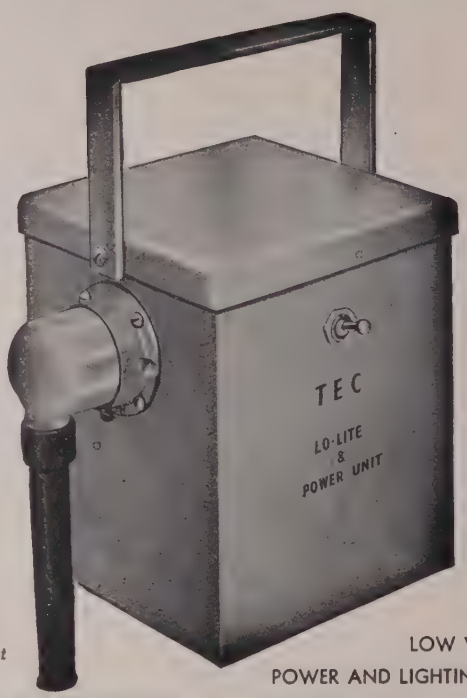
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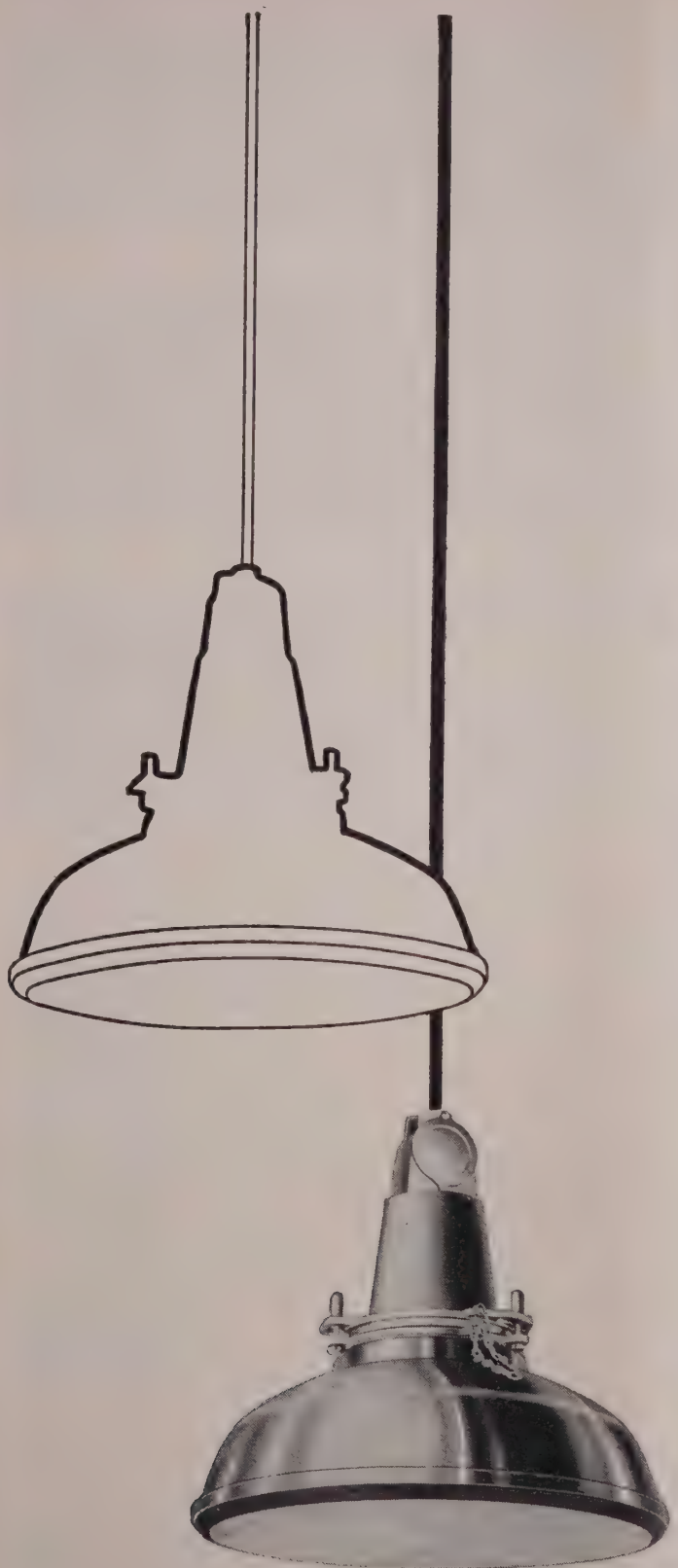
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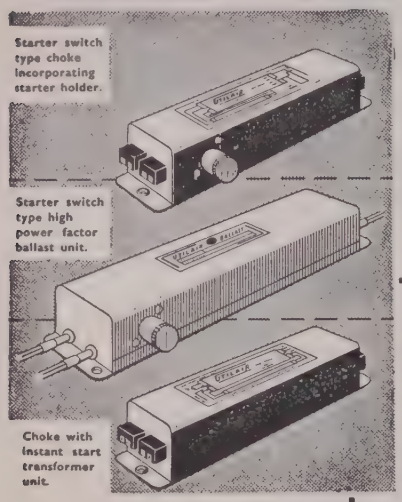
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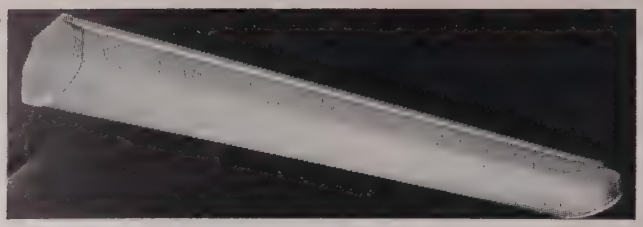
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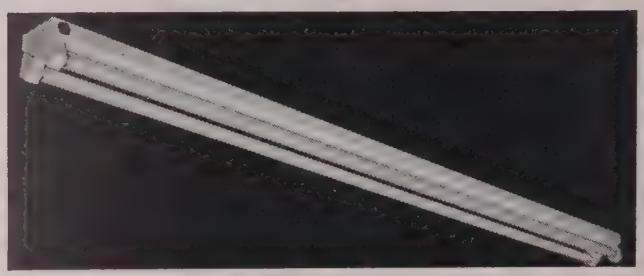
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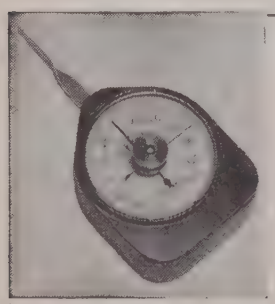
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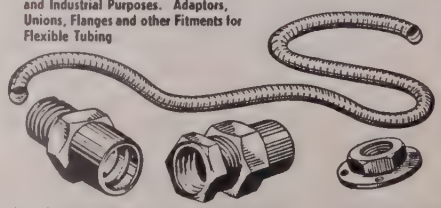
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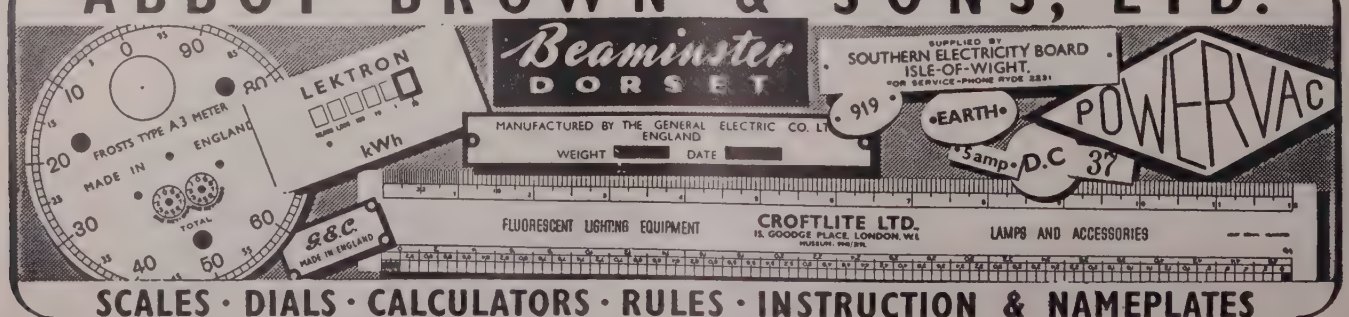
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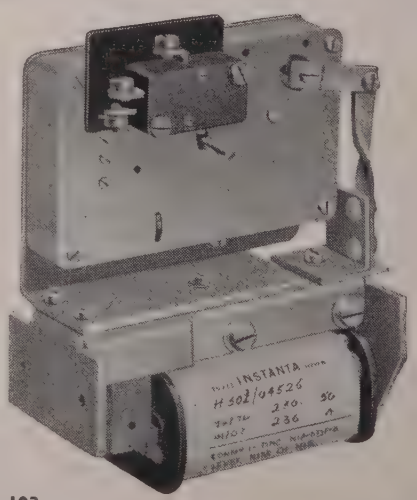
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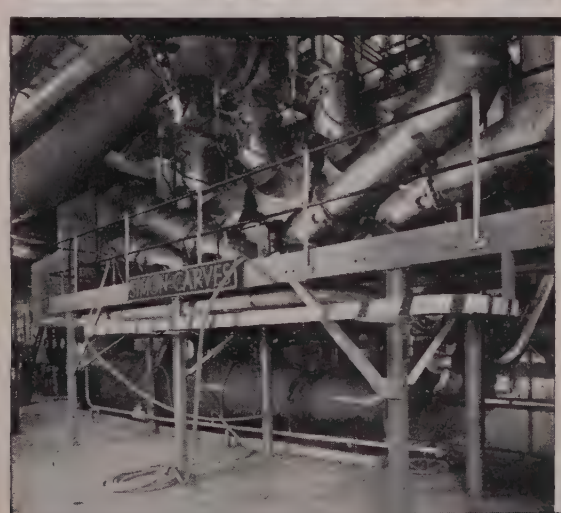
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left. The operating front of the boiler is housed in the turbine building. Fuel can be blast furnace gas or fuel oil or a mixture of both.

right. The central control panel. From here, both the boiler and the high pressure turbines are controlled.



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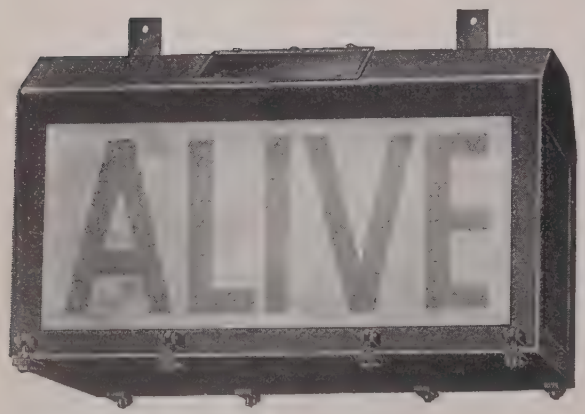
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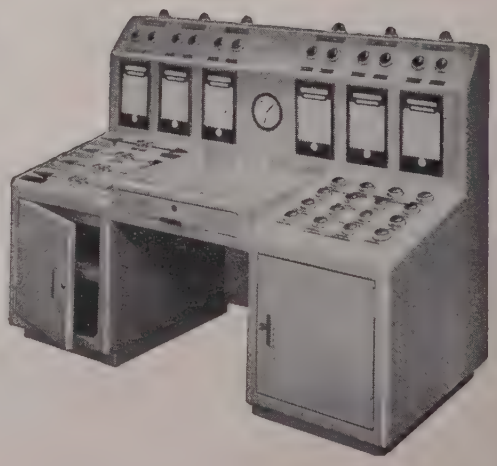






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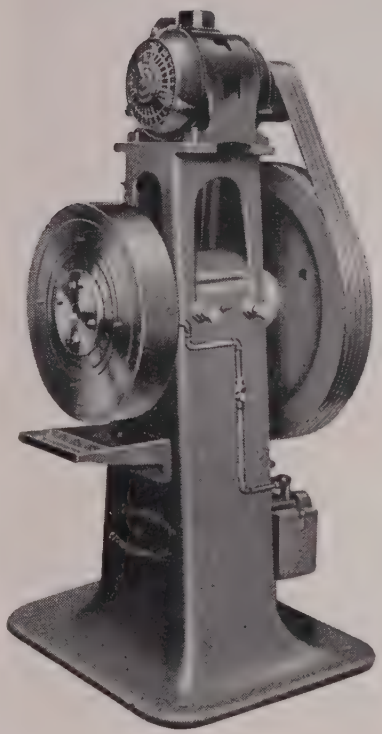
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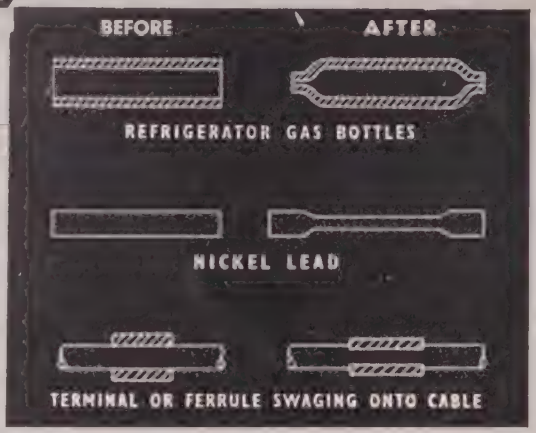
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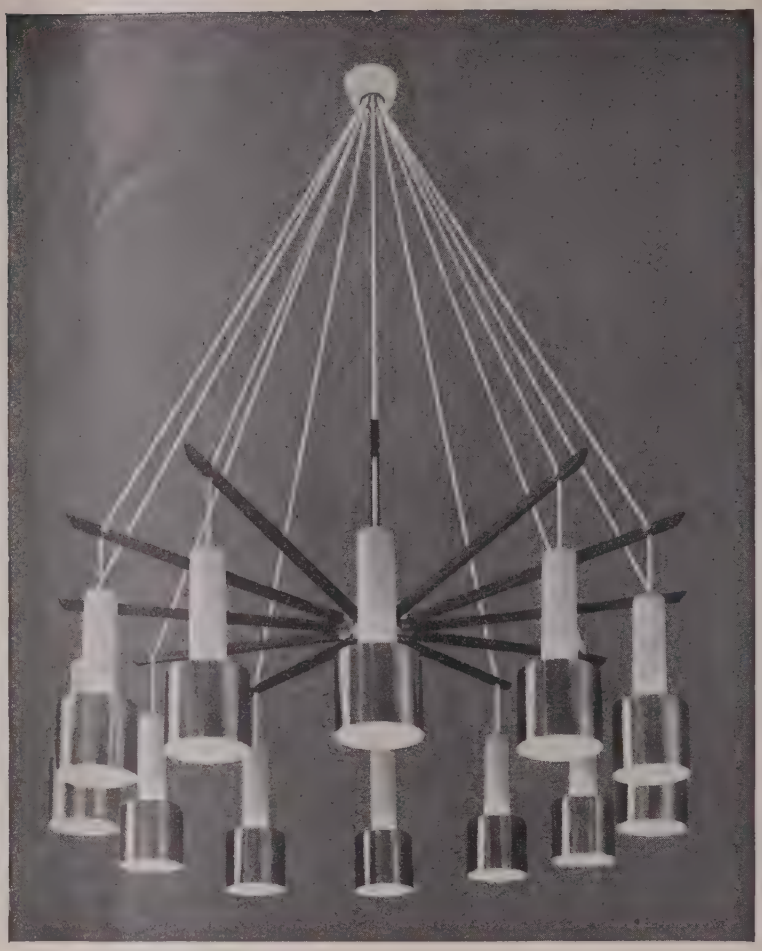
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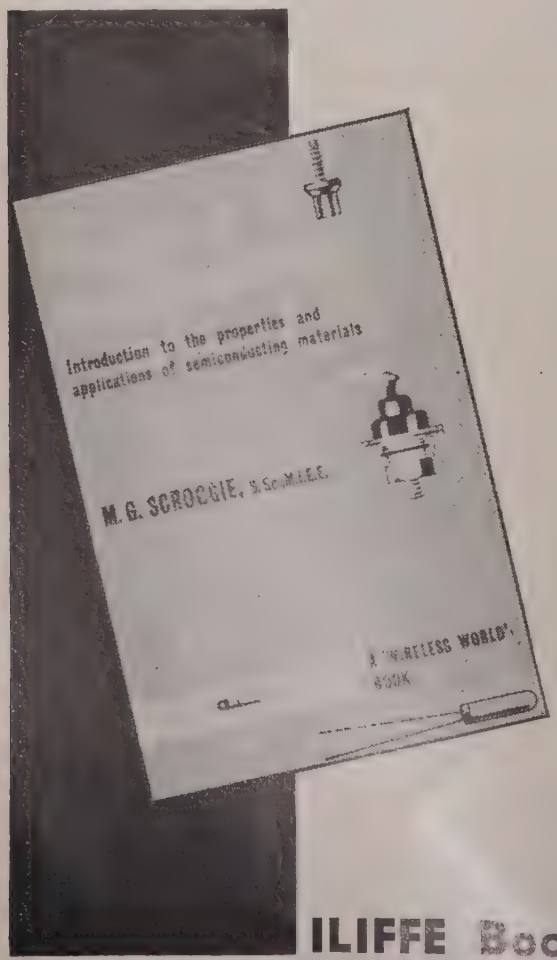
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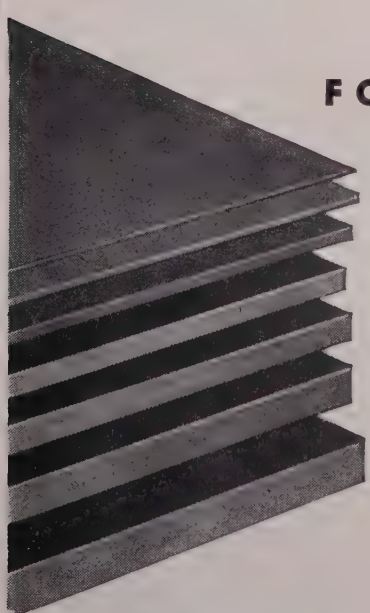
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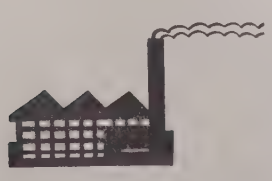
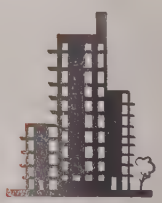
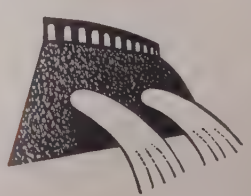
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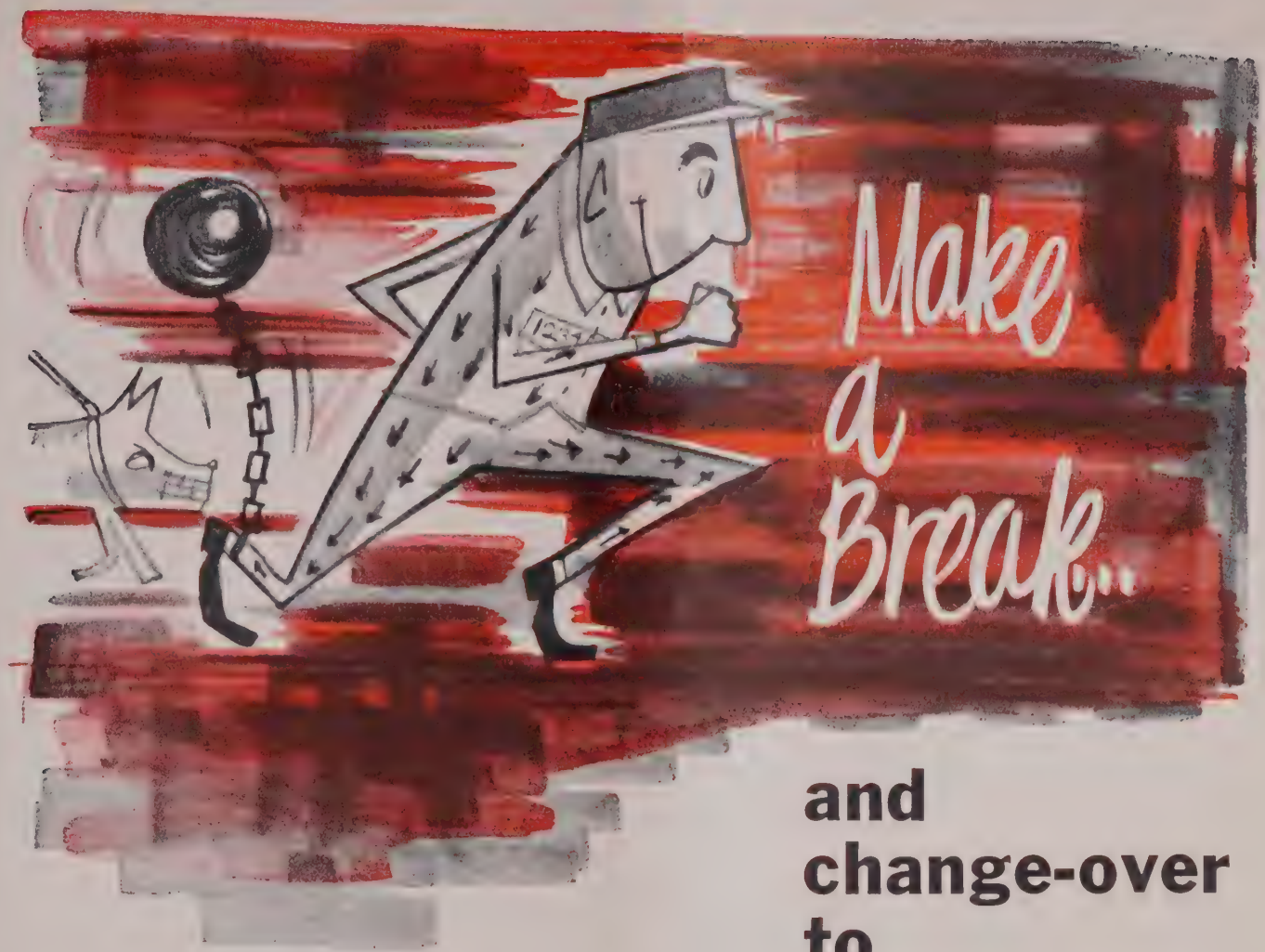
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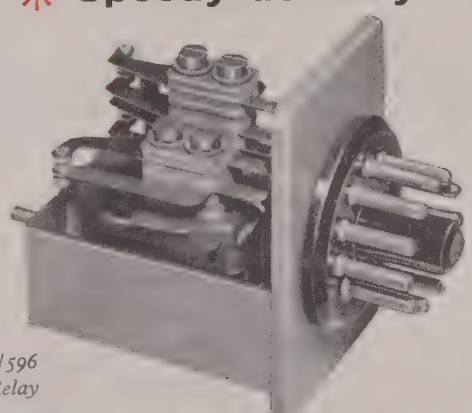
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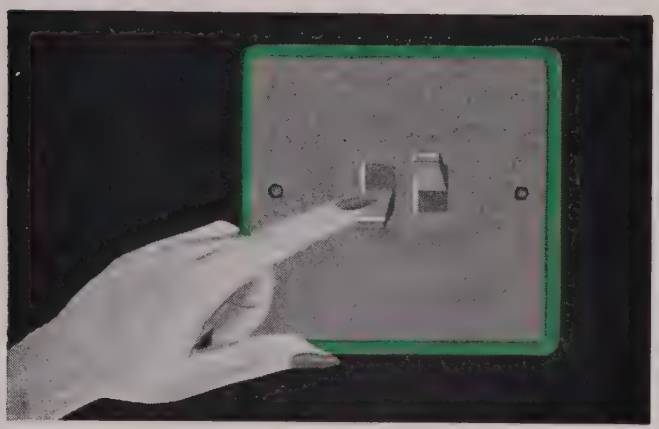
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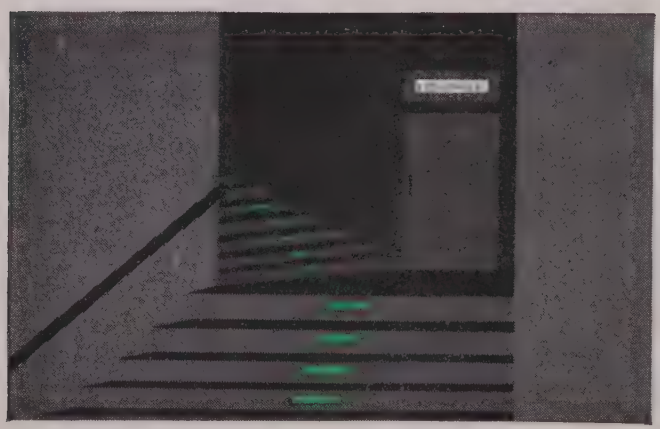
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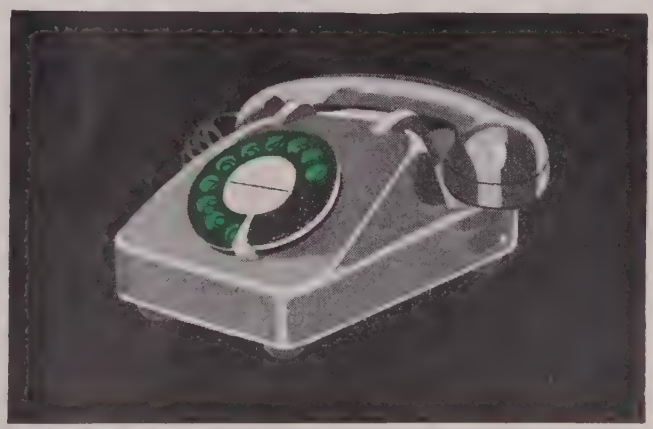












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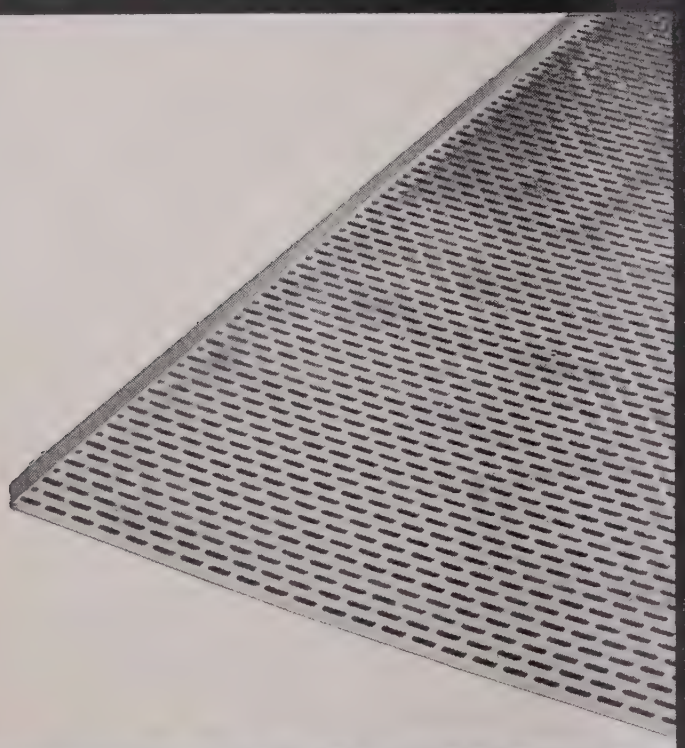
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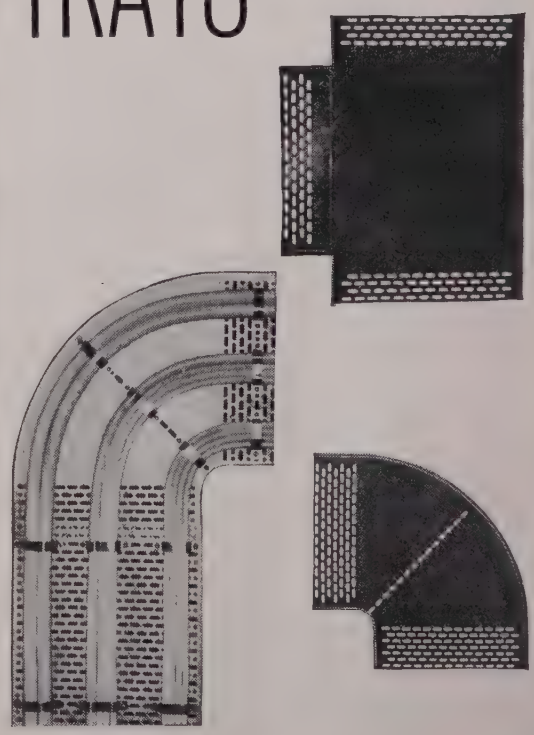
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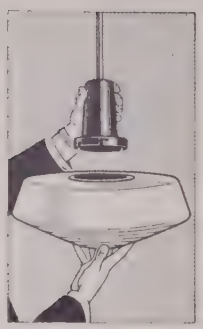
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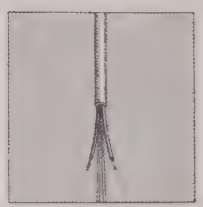
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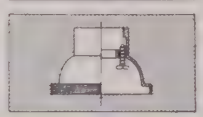


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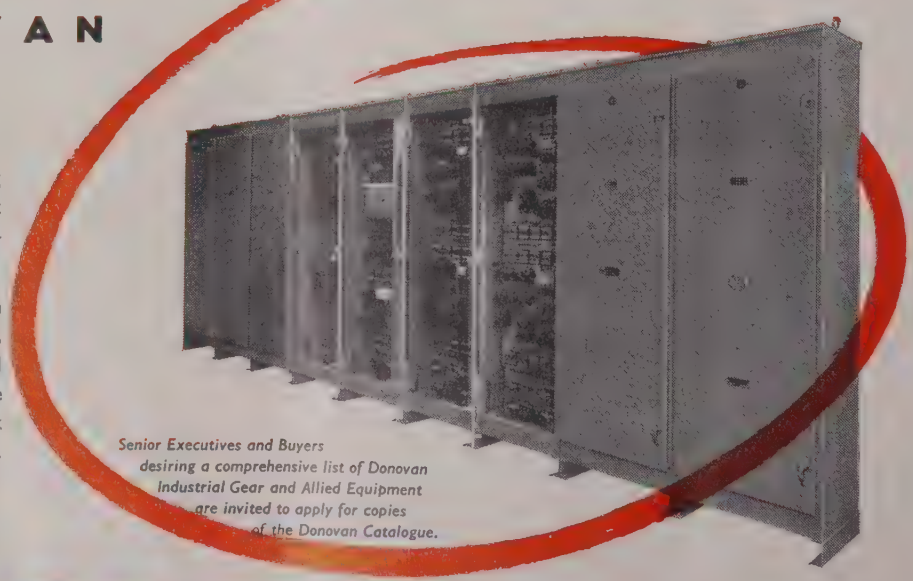
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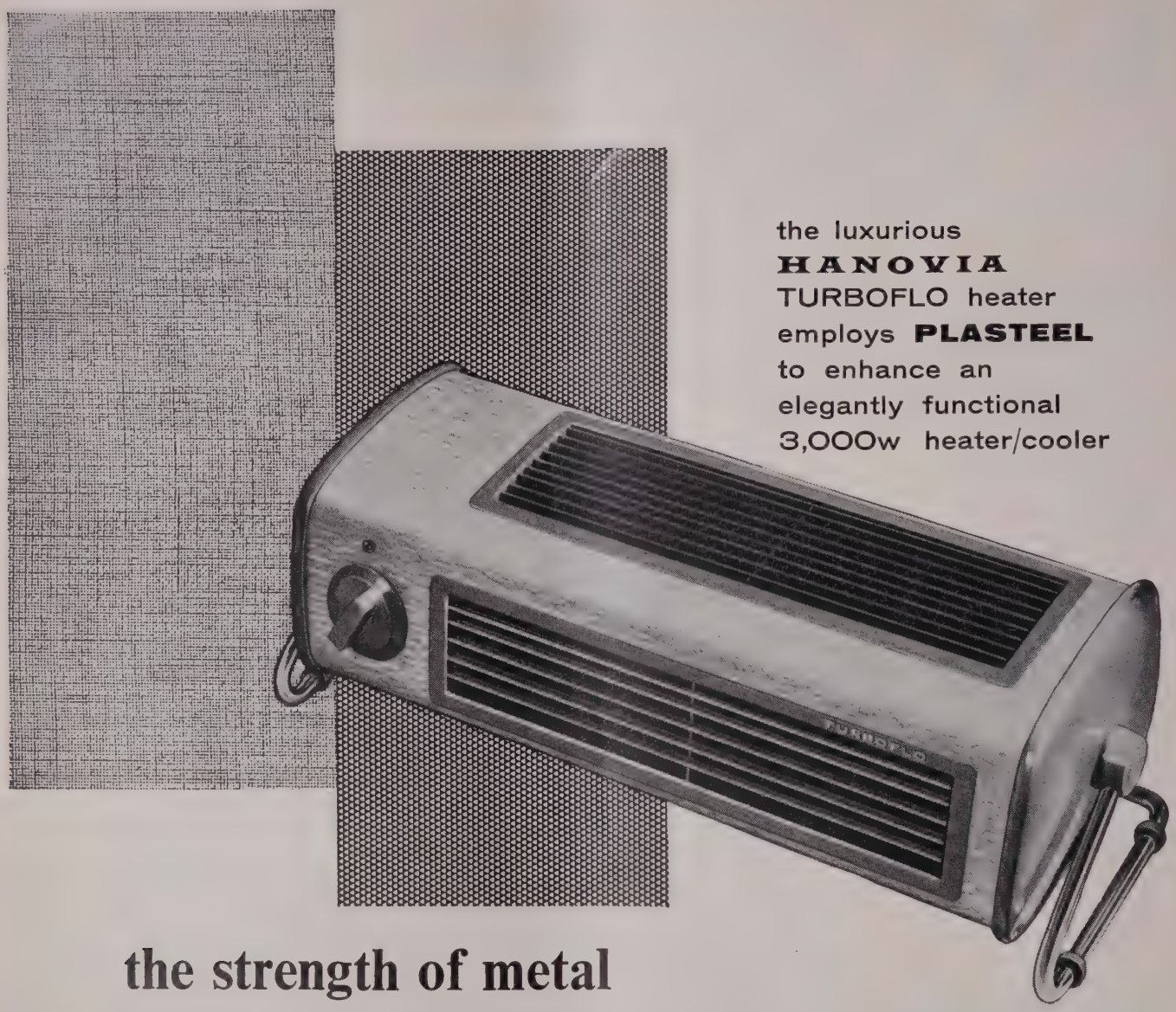


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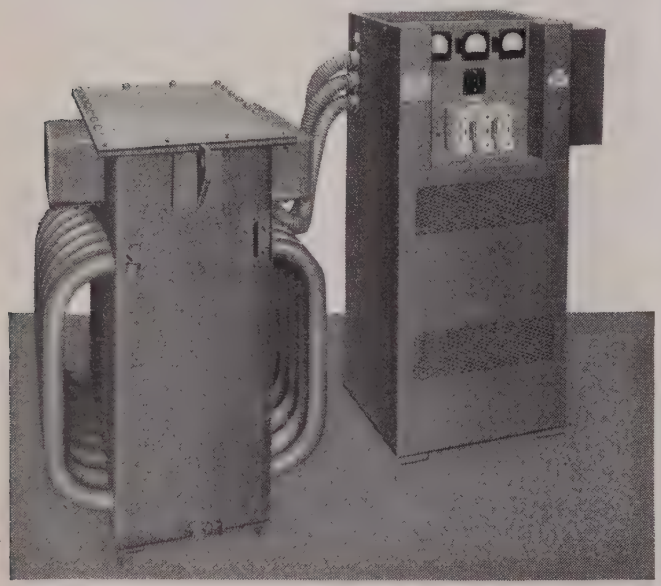
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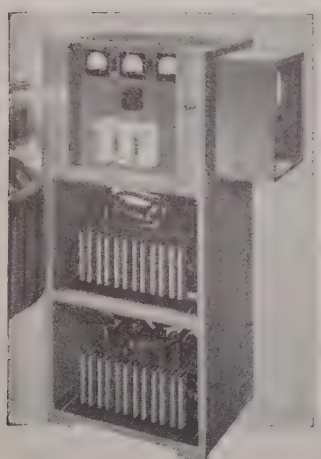
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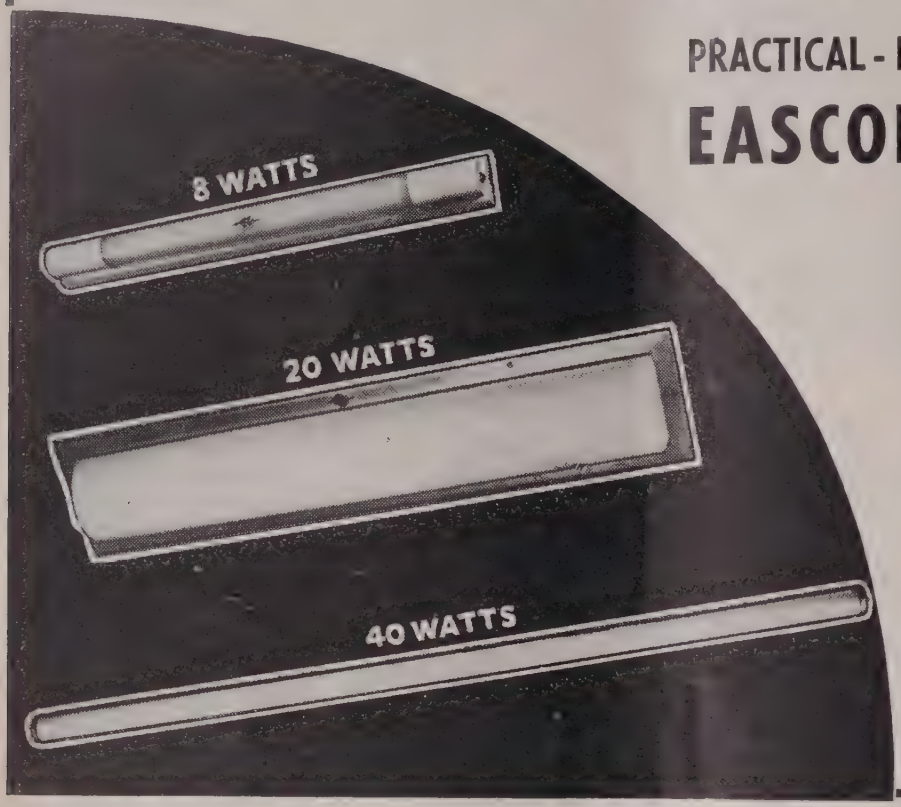
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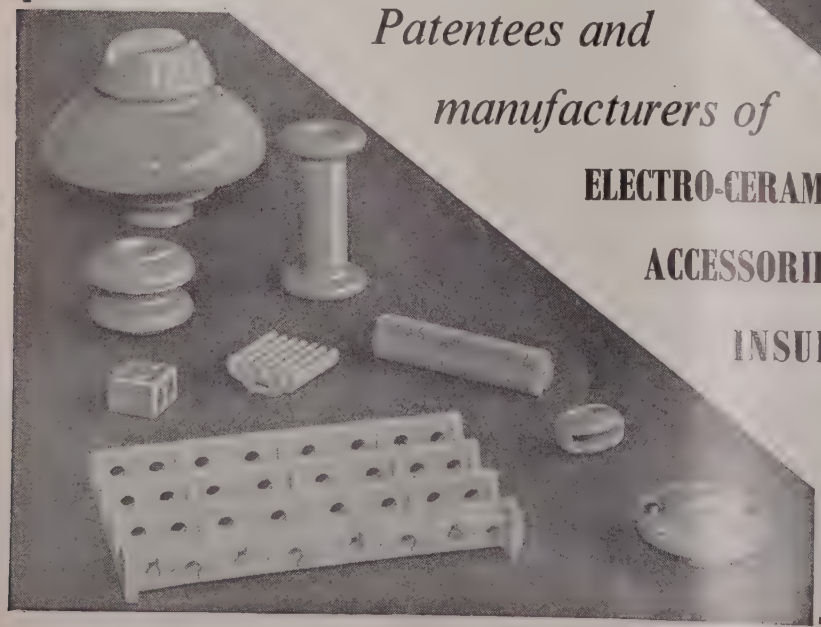
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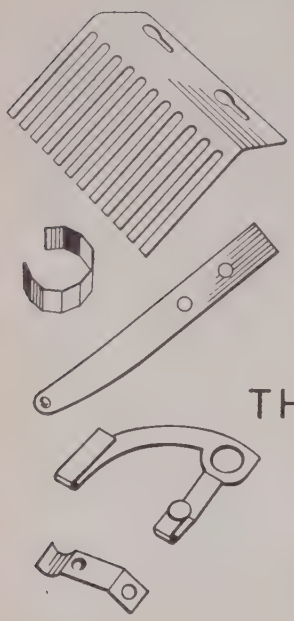
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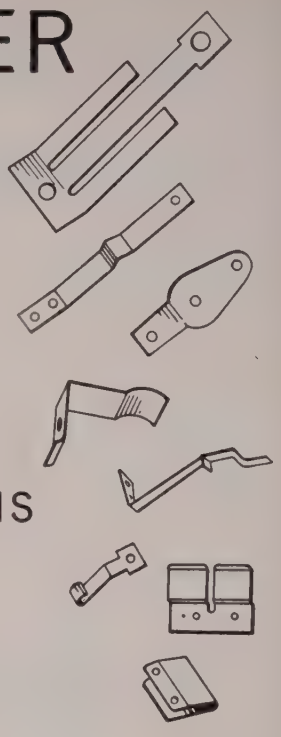
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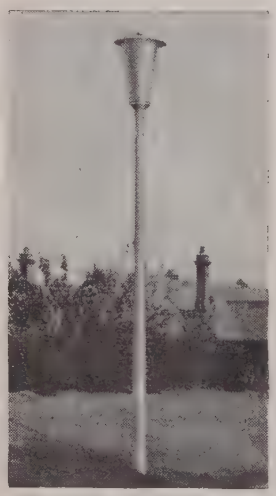
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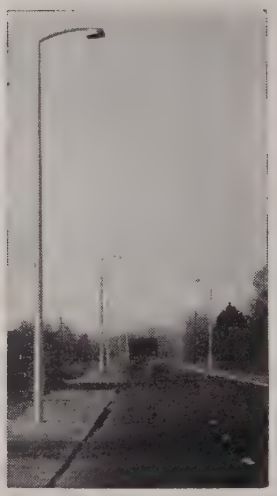
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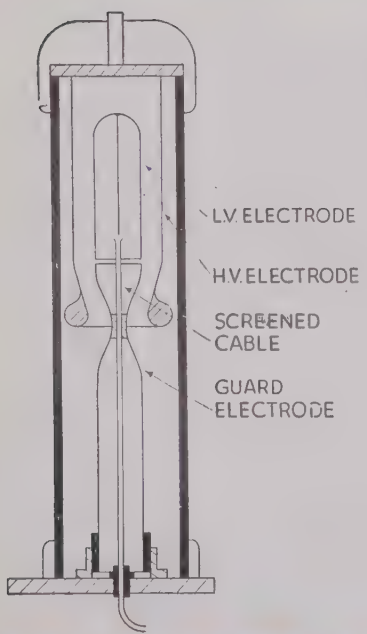
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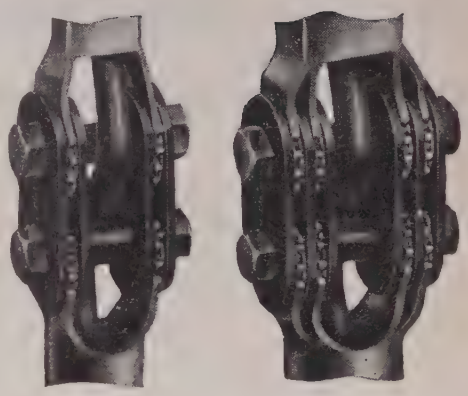
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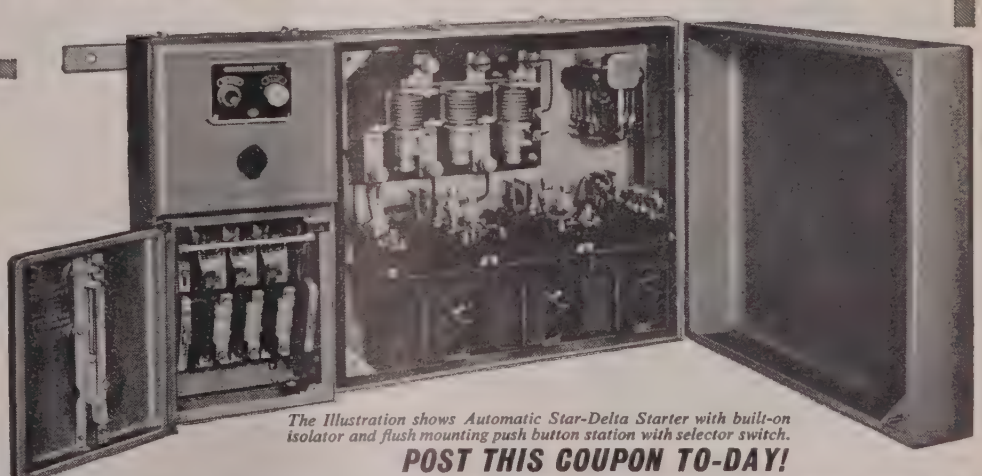
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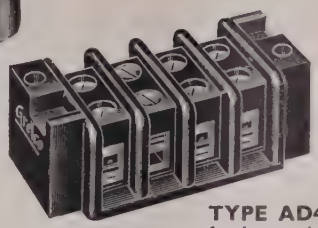
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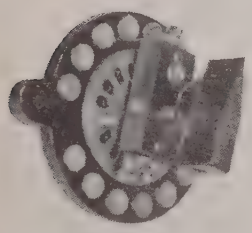
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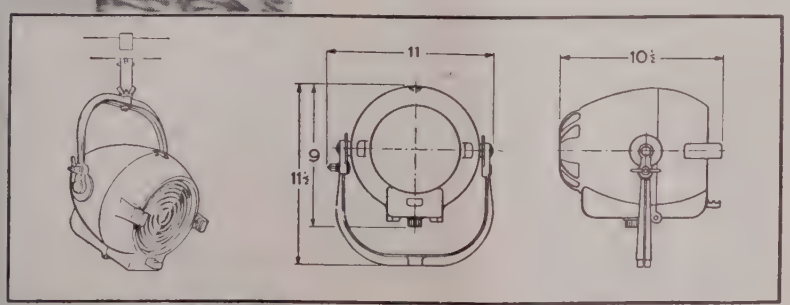
LIGHTING FOR ENTERTAINMENT

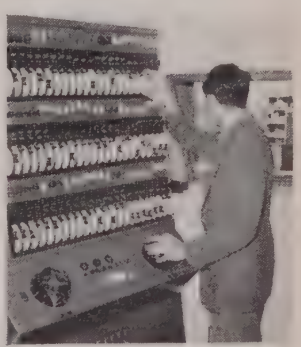
Ideally this type of lighting should be built in. Often this is not practicable. For example, rostrums in town halls or temporary stages in public assembly halls can often be effectively lit only from lanterns in full view of the audience.

In such cases the Strand Baby Spot, illustrated here, provides the only really satisfactory answer. It is a neatly styled, compact lantern quite unobtrusive and capable of a higher light output than many much bulkier lanterns.

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Strand Patt. 123 and 23 Baby Spots are neatly styled and of small dimensions so that concealment is often unnecessary.





The above illustration shows a Strand all-electric Saturable Reactor Remote Dimmer Control in use at Adelaide University. This control requires little maintenance and being extremely compact is ideal for small lighting installations up to 54 ways. This type of dimmer accounts for 5,000 of the 16,000 remote controlled Strand dimmers in use.

STRAND ELECTRIC

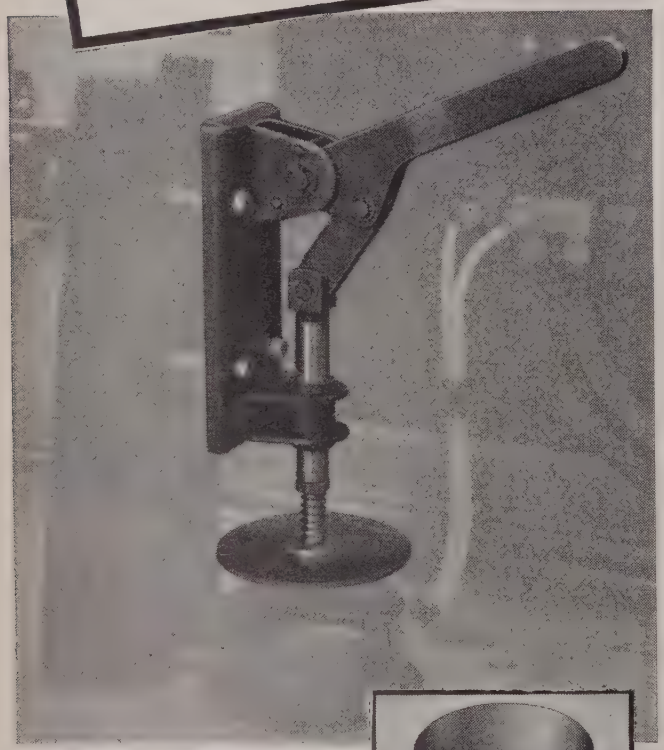
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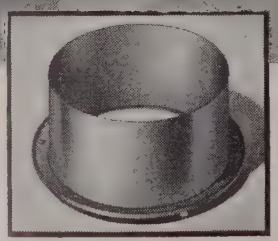
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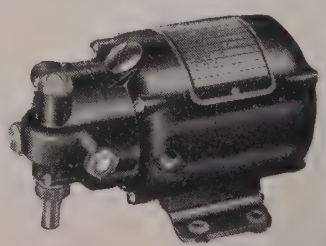
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Dynamically balanced Armatures and Rotors.



SERIES WOUND GEARED MOTOR—Type 'K'

R.P.M.	TORQUE	R.P.M.	TORQUE
600	10 oz. in.	37.5	4 lb. in.
300	16 oz. in.	25	4 lb. in.
150	24 oz. in.	18.8	4 lb. in.
100	32 oz. in.	12.5	4 lb. in.
75	36 oz. in.	9.4	4 lb. in.
50	3 lb. in.	6.25	4 lb. in.

SHADED-POLE INDUCTION GEARED MOTOR—Type 'FA'

R.P.M.	TORQUE	R.P.M.	TORQUE
216	4 oz. in.	13.5	24 oz. in.
108	7 oz. in.	9	30 oz. in.
54	10 oz. in.	6.7	35 oz. in.
36	12 oz. in.	4.5	44 oz. in.
27	15 oz. in.	3.35	3 lb. in.
18	20 oz. in.	2.25	4 lb. in.

VARIABLE SPEED GEARED MOTOR—Type 'KQ

R.P.M.	TORQUE	R.P.M.	TORQUE
200-600	9 oz. in.	12-37.5	4 lb. in.
100-300	16 oz. in.	8-22	4 lb. in.
50-150	20 oz. in.	6-16.5	4 lb. in.
32-100	32 oz. in.	4-11	4 lb. in.
25- 75	40 oz. in.	3- 8.25	4 lb. in.
16- 50	48 oz. in.	2- 5.5	4 lb. in.

CAPACITOR INDUCTION GEARED MOTOR—Type 'N'

R.P.M.	TORQUE	R.P.M.	TORQUE
456	8 oz. in.	28.5	3 lb. in.
228	13 oz. in.	19	4 lb. in.
114	21 oz. in.	14.2	4 lb. in.
76	26 oz. in.	9.5	4 lb. in.
57	32 oz. in.	7.1	4 lb. in.
38	44 oz. in.	4.75	4 lb. in.

CITENCO LIMITED

MANOR WAY - BOREHAM WOOD HERTS - ENGLAND
Telegrams: Citenco Borehamwood *Telephone:* Elstree 3666-7-8

COMPACT HORSEPOWER with the

AEI British Standard Dimension Motors

More compact machines and lower cost for the same horse-power—these are some of the advantages of specifying the newest AEI motors. Manufactured in accordance with BS2960 the range covers ventilated drip-proof motors (Type KN-C) and totally enclosed fan-cooled motors (Type KN-D) of 1-50 h.p., with Class "E" insulation and 65°C temperature rise.

Write for leaflet 3501-92.



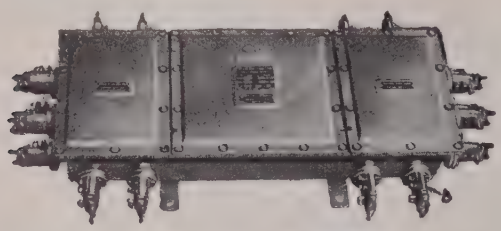
AEI Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY & MANCHESTER, ENGLAND

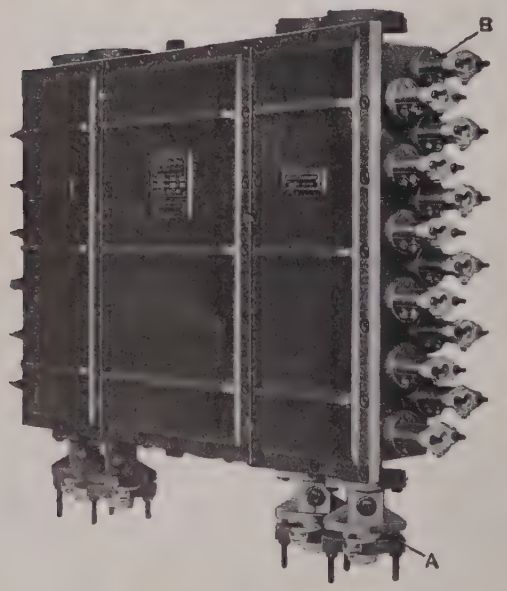
A5439

NEW NELBEST

FLAMEPROOF LINK TYPE CONNECTING BOXES

with sliding test link





Available in a wide range of sizes suitable for all types of interlocking and signalling schemes in hazardous areas, the maximum number of links in each group of box sizes is variable from 6 to 90.

RATING 660 VOLT 15 AMPS.

- ★ Mild steel case complying to BSS 229.
- ★ Terminals separated by insulated barrier. Connection made by surface clamp on cable using connecting head screw.
- ★ Terminals and links numbered as required.
- ★ Cable entries by brass gland sets wire armoured cable fitted to sealing box. Quantity and type to suit customers' requirements.

Associated relay panels, limit switches, etc., also available.

W. & H. NELSON LTD.

NELBEST WORKS, MOSSEND, SCOTLAND
Telephone: Bellshill 3133-3302
Telegrams: "Nelbest, Bellshill"

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GROUPS 1 & 2

EXPRESS DELIVERY— EX STOCK



Specialists in Admiralty Pattern Cable Glands, Cable Entry Tubes, Sockets Soldering and Crimping Types, Cable Clamps, Machining of Switchgear Components.

Prototypes and Specials to customers' drawings and requirements.

Stocks held of Glands and Sockets.

H. N. ELECTRICAL ENGINEERING LTD.

Rochelle Works, Brixton Hill Place, London, S.W.2
Telephone: TULse Hill 3251/2/3

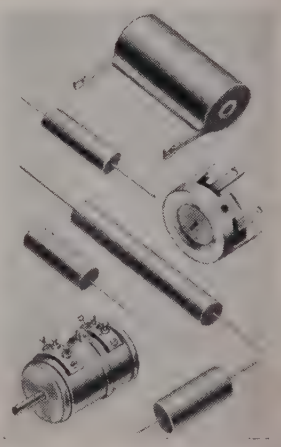
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Evanohm Resistance Alloy

Evanohm is specially recommended in the manufacture of Potentiometers, high ohmic Resistors, and precision instruments, where high stability over a wide temperature range is essential.

Evanohm possesses a very low thermal E.M.F. against copper—less than 2-5 microvolts per degree C between 0 and 100 C. It has a high tensile strength in fine sizes, high specific resistance, and is non-magnetic.

Evanohm is supplied in wire form either bare or insulated with enamel, silk, nylon, cotton or glass.



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Telephone: WHitehall 6058

★ For complete data on all resistance alloys and stainless steel wire, write for a copy of our Resistance Handbook.



Inside the works a specialist works inside the works of a Lindley Thompson transformer. As you know, this highly respected firm produces extremely efficient power transformers, standard *and* special, in many different sizes.

A bird's-eye view of the winding of a Lindley Thompson radial type transformer.

The Lindley Thompson Transformer & Service Co. Ltd.

St. Mary's Road, Langley, Slough, Bucks.

A Member of the PE Group of Companies.

We make the right electrode for every resistance welding job



For every requirement there is an ELMET electrode that is *exactly* right, giving the highest possible rate of production with the minimum of maintenance and replacement. From an extensive range, we can supply STANDARD shapes in STANDARD materials for:

SEAM WELDING ("ELMET" Copper-base Alloys)
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PROJECTION WELDING
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ELECTRICAL UPSETTING
("COPELMET" Sintered Compound Metals)

SPECIAL jobs may demand SPECIAL shapes and SPECIAL materials. We can supply these in any form required, as

COMPLETE DIES
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TIPS
BARS of various sections and sizes

Please ask us for Publication 52, which gives more information; or let us discuss your problem with your own Production Engineers.

ELMET Copper-base Alloys
COPELMET Sintered Compound Metals

METRO-CUTANIT LIMITED GRAPPENHALL WARRINGTON LANCASHIRE
Telephone: Grappenhall 906

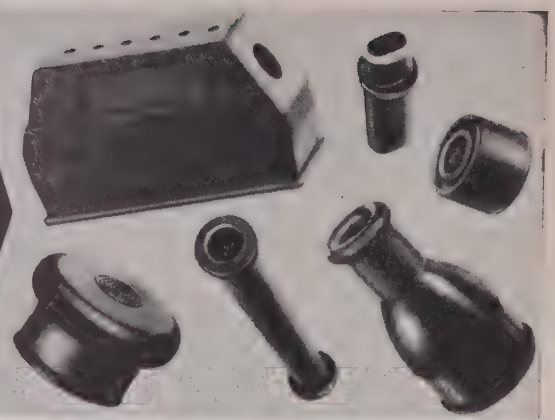
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Specialisation plus 60 years experience ADDS UP TO THE

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Our technical staff are fully qualified to discuss and advise on problems, so that Dainite Rubber Mouldings, can be produced to your own requirements.
Fully approved A.I.D. and A.R.B.



THE HARBORO' RUBBER CO., LTD. Dainite Mills, Market Harborough. Telephone 2274/6

WEATHERPROOF METAL-CLAD SOCKETS, PLUGS, SWITCH SOCKETS etc.
for all electrical purposes



SIMMONDS & STOKES (NIPHAN) LTD
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Victoria House, Southampton Row, London, W.C.1. HOLborn 2163, 8637



CABLES ENCLOSED THROUGHOUT.
BENCH, WALL or CONDUIT BASE
FOR ALL TYPES OF
Industrial local lighting

INVISAFLEX

From ELECTRICITY SERVICES
6 Laurence Pountney Hill, London, E.C.4.



We recommend
SHELL-MEX AND B.P. GASES LTD.
PROPAGAS PROPANE
for details apply SHELL-MEX AND B.P. GASES LTD.
Cecil Chambers, 76-86 Strand, London, W.C.2.

TYERS LIQUID GAS EQUIPMENT

THE PORTABLE FURNACE AND PATENTS CO.
CARRINGTON, NOTTINGHAM
ENGLAND
Telephone:- NOTTINGHAM 64887
Telegrams:- 'FURNACE, NOTTINGHAM'

R

Power Centre

lighting trunking & cable tap trunking completely adaptable





* The Power Centre Lighting Trunking provides an economical fluorescent lighting system incorporating power tap facilities for power distribution without drilling.
* The Power Centre system of cable tapping is a simple method of distributing power to small machines with the facility of a busbar system but at lower cost.

Power Centre Trunking is jig built for ease of installation — zinc coated for protection and completely adaptable.

Send for full details.

Power Centre products include:

All forms of cable trunking
Busbar trunking
Rising Mains
Cable Tap System
Lighting Trunking
Switch and Fuse Gear

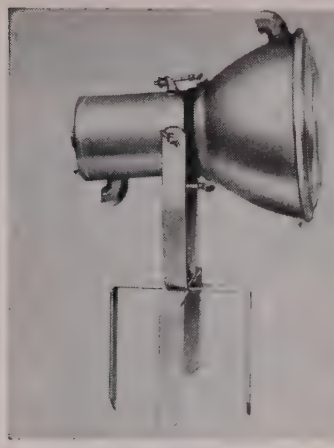
PC

POWER CENTRE

The Power Centre Co. Ltd, P.O. Box 18
Lloyd Street, Wednesbury, Staffs.

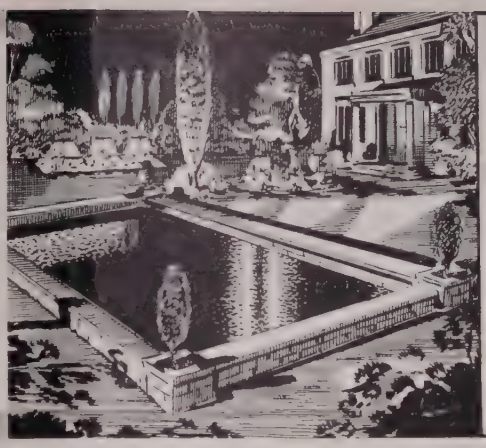
ELECTRICAL DIVISION

CTI



'FESTIVAL' FLOODLANTERNS

Built to withstand severe weather conditions particularly suitable for temporary Floodlighting installations. The outright cost of these Lanterns compares favourably with normal hiring charge of standard equipment.
Illustration shows 150 Watt Lantern mounted on 970 Base.
PRICE: complete 58/4d. each





NEW TURF SPIKE MOUNTING BASE

Particularly convenient for garden installations.
List No. 970. suitable for small Floodlanterns.
Size: 6 × 6" with 6" legs.
PRICE: 9/- each.
List No. 971. suitable for medium sized Floodlanterns.
Size: 12" × 12" with 9" legs.
PRICE: 16/- each.

REAL FLOODLIGHTING EQUIPMENT

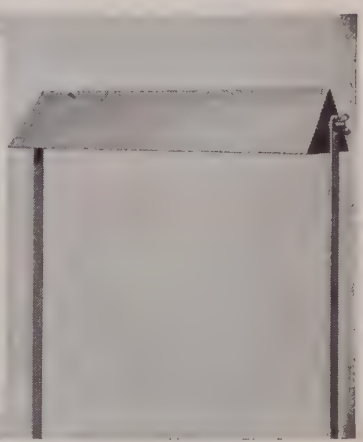
R.E.A.L. IS A REGISTERED TRADE MARK.

Clearly the BEST

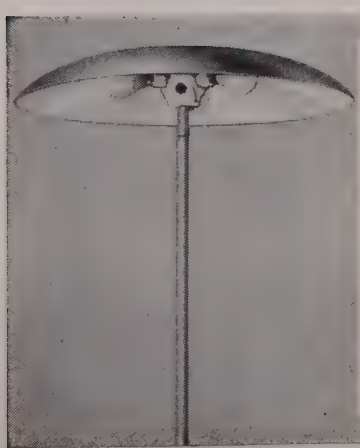


'GARDEN' TROUGH LIGHT

For local lighting in park or garden.
When positioned as shown it is suitable for lighting flower beds and general floral displays. Can be adjusted to any angle for the illumination of herbaceous borders etc.
List No. 1240.
PRICE: 60/- each.

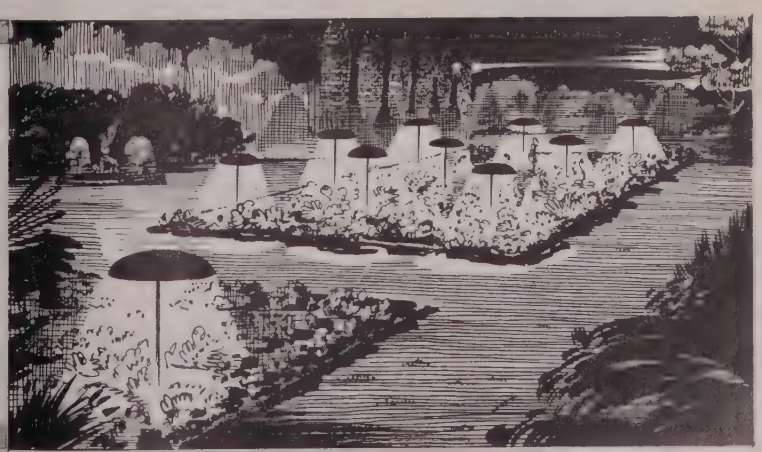


There is a rapidly increasing demand for simple but effective garden Floodlighting equipment. These new fitments are shown on Leaflet P. 6107.
The R.E.A.L. range of Floodlanterns, comprising some fifty different units, is illustrated in List P. 6004.



'MONKSCAP' GARDEN UNIT

New three lamp model, 24" dia. arranged for mounting to ¾" conduit upright. Choice of four contemporary colours, Citron Yellow, Cherry Red, Willow Green and Dove Grey, inner reflecting surface white enamel.
List No. 1241.
PRICE: (without conduit upright) 84/- each.



ROWLANDS ELECTRICAL ACCESSORIES LIMITED, R.E.A.L. WORKS, BIRMINGHAM 18.

Smith House Service Meters

ensure quality control

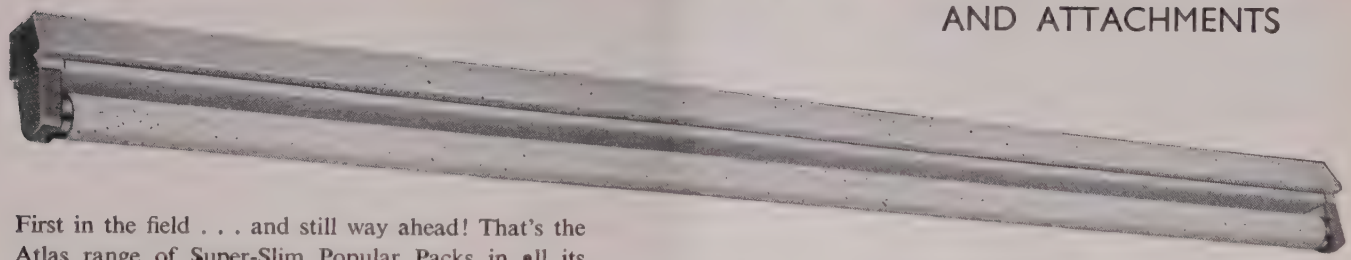


Smith Meters Limited

ROWAN ROAD • STREATHAM VALE • LONDON • S.W.16 • TELEPHONE: POLLARDS 2271

atlas SUPER-SLIM popular packs

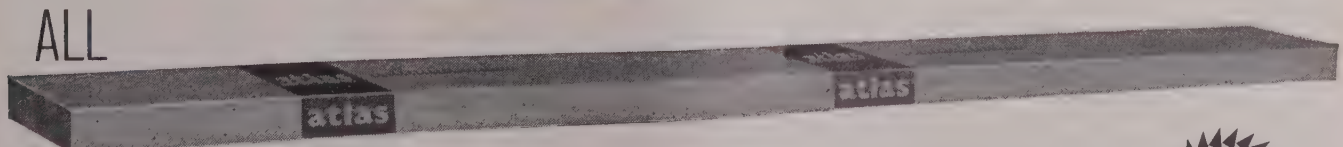
AND ATTACHMENTS



First in the field . . . and still way ahead! That's the Atlas range of Super-Slim Popular Packs in all its variations. The new I.E.S. Code shows that bare tube installations are undesirable—here are inexpensive diffusers and 'Clipluve' to bring your lighting up-to-date.

	8ft. 125w	5ft. 80w	4ft. 40w.	2ft. 20w
Switchstart batten fitting (inc. gear and tube)	HDS.1125 **£7. 6. 0** No. P. Tax	HDS.1080 **£4. 11. 6** inc. 2/- P. Tax	HDS.1040 **£3. 14. 7** inc. 1/10d. P. Tax	HDS.1020 **£2. 16. 0** inc. 1/9d. P. Tax
Slickstart batten fitting (inc. gear and tube)	—	HDP.1080 **£4. 19. 2** inc. 2/- P. Tax	HDP.1040 **£4. 2. 2** inc. 1/10d. P. Tax	—
ATLAS HDZ Open-end metal trough reflector with slots to allow upward lighting.	HDZ.18 **£2. 5. 0** No P. Tax	HDZ.15 **£1. 3. 0** No P. Tax	HDZ.14 **£1. 1. 6** No P. Tax	—
ATLAS HDY A translucent closed-end trough in opal perspex for upward lighting.	—	HDY.15 **£3. 5. 0** No P. Tax	HDY.14 **£2. 18. 0** No P. Tax	—
ATLAS HDX Angle metal trough reflector especially suitable for 'directional' lighting.	HDX.18 **£1. 16. 0** No P. Tax	HDX.15 **£0. 18. 0** No P. Tax	HDX.14 **£0. 17. 0** No P. Tax	HDX.12 **£0. 15. 0** No P. Tax
ATLAS HDW An attractive diffuser in extruded plastic with blue end panels for display purposes.	HDW.18 **£3. 12. 1** inc. 12/1d. P. Tax	HDW.15 **£2. 8. 1** inc. 8/1d. P. Tax	HDW.14 **£2. 3. 3** inc. 7/3d. P. Tax	HDW.12 **£2. 0. 1** inc. 5/1d. P. Tax.
ATLAS HDN A versatile attachment in opal plastic suitable as a diffuser for store display.	—	—	HDN.14 **£1. 12. 4** inc. 5/4d. P. Tax	HDN.12 **£1. 2. 10** inc. 3/10d. P. Tax
ATLAS HDA Acelon diffuser with wooden end panels ideal for wall mounted applications.	—	—	HDA.1040 **£3. 14. 6** inc. 12/6d. P. Tax	HDA.1020 **£3. 3. 4** inc. 10/8d. P. Tax
ATLAS HDL Aluminium parabolic anodised reflector providing a narrow beam of light.	—	HDL.1080 **£4. 10. 0** No P. Tax	—	—
ATLAS 'CLIPLUVE' Moulded in translucent opal plastic and supplied in sections for instant attachment direct to tubes.	Pack of FIVE sections **£1. 16. 1** inc. 6/1d. P. Tax.			

ALL



PRE-PACKED READY TO INSTALL OR READY TO SELL

atlas FLUORESCENT LIGHTING FOR ALL

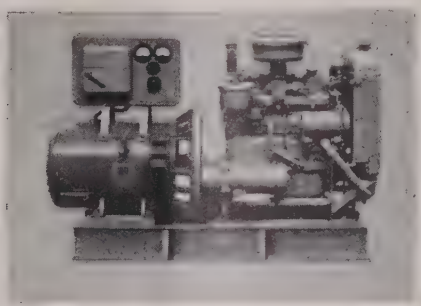
ATLAS LIGHTING LIMITED · THORN HOUSE · UPPER ST. MARTIN'S LANE · LONDON WC2

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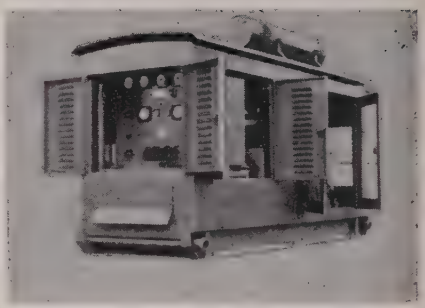
PELAPONE IN POWER FOR 50 YEARS



Automatic diesel 12 kVA 'no-break' generating set

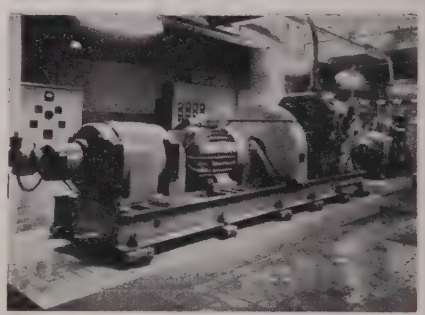


Water-cooled standardised generating set of the Pelapone 'Crown Range'



Transportable self-contained 20 kW diesel-alternator set

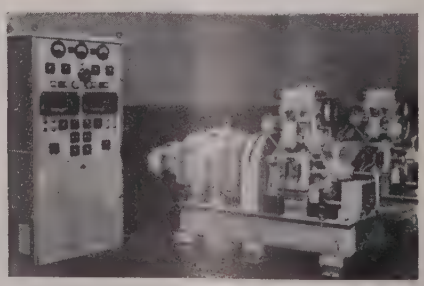
For over half a century Pelapone have produced a range of equipment to meet virtually every need in the field of electrical power supply. Today, with Pelapone well to the fore in contemporary development, this equipment is earning the unqualified approval and confidence of engineers everywhere



55 kVA 'no-break' generating plant serving Madrid telephone exchange



Self-contained 22 kVA trailer generating set



Double unit mutual stand-by generating set

PELAPONE LIMITED,

Sales Division:
STEEL HOUSE, EASTCOTE,
MIDDLESEX, ENGLAND
Telephone: PINner 5881
Cables: Pelapone, London
Works: P.O. Box 4, Derby

979

Controlled Power—Continuous Power

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CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to: Classified Advertisement Department, ELECTRICAL REVIEW Dorset House, Stamford Street London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

ROYAL BURGH OF INVERURIE

Relighting of Trunk Road A.96

TENDERS are invited for the supply and erection of Lighting Columns and Brackets on Trunk Road A.96 within the Burgh of Inverurie, Aberdeenshire. The work provides for a change from existing lighting to sodium lighting, the re-positioning of various lamp standards and the supply and installation of certain new equipment. Forms of tender, conditions of contract, specifications and schedule of quantities may be obtained from Robert M. Bruce, Burgh Surveyor, Burgh Surveyor's Office, Town House, Inverurie, Aberdeenshire, at whose office relevant drawings may be seen.

Tenders in plain sealed envelopes not bearing any name or mark indicating the sender, and endorsed "Trunk Road Lighting," to be delivered to the undersigned not later than 10 a.m. on Monday, 2nd October, 1961.

The Town Council do not bind themselves to accept the lowest or any tender.

G. D. KELLAS,
Town Clerk.

Inverurie,
Aberdeenshire.

2264

NEATH RURAL DISTRICT COUNCIL

Street Lighting Road B.4434: Tonna

TENDERS are invited for the supply and erection of 37 fifteen-ft. Concrete Columns and 37 60-watt Sodium Lamps, Lanterns, together with all auxiliary gear and wiring.

General conditions of contract, specification and bill of quantities may be obtained from, and plans inspected at, the department of the Engineer and Surveyor (Mr. J. T. Jones, F.R.I.C.S.), 18, Orchard Street, Neath, on payment of £2 2s., which will be refunded on receipt of a bona fide tender.

Tenders in plain sealed envelopes, endorsed "Street Lighting for Tonna Road," must be sent to the undersigned so as to reach him not later than Monday, 2nd October, 1961.

I. H. K. THORNE,
Clerk of the Council.

Orchard Chambers,
Orchard Street, Neath.

2211

GHANA SUPPLY COMMISSION

THE GHANA SUPPLY COMMISSION invite manufacturers to submit quotations for the following:—

Reference ELEC. 4082/1.
Description: Underground Paper-insulated Lead-covered and Armoured Cables:—
(A) 11,000 volts — 31,000 yds.
(B) 3,000 volts — 13,000 yds.
(C) 1,000 volts — 24,000 yds,

Specifications for the cables will be obtainable as from the 30th August, 1961, on payment of a fee of £1, from the Secretary, Ghana Supply Commission, Post Office Box M-35, Accra. The closing date for receipt of quotations will be 4th October, 1961.

2109

BOROUGH OF SLOUGH

TENDERS are invited for electrical installation work of an industrial nature on a portion of the plant at the Council's Sewage Disposal Works, Cippenham, Slough.

Tendering documents may be obtained on payment of a deposit of one guinea from the Borough Engineer, Town Hall, Slough.

Tenders to be delivered to Town Clerk in envelope provided not later than noon on 5th October, 1961.

2252

CITY OF MANCHESTER

TENDERS invited for Electrical Installation to Combined Clinic, Withington.

Specification and drawings from City Architect, P.O. Box 488, Town Hall, Manchester, 2.

Tenders returnable by 18th September.

2221

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region
North Thames Division

APPLICATIONS are invited for the following appointment in the ELECTRICAL DEPARTMENT at Divisional Headquarters, Cockfosters (North London).

FOURTH ASSISTANT ENGINEER
(Metering) (S.V. No. 1538).

Salary N.J.B. Class J, Grade 9, Scale 9, £1,040-£1,245 per annum plus London weighting £50 per annum.

The duties of the successful applicant will be to assist in the commissioning, routine testing and maintenance of bulk supply metering equipment, testing and maintenance of indicating instruments and originating equipment connected with the Centralised Indication System.

Applicants should have had some experience of such work and should hold the Higher National Certificate in Electrical Engineering, or its equivalent, with qualifications leading to Graduate Membership of the Institution of Electrical Engineers.

The duties will be almost entirely at generating stations and substations, and it would be an advantage if applicants can drive a car.

Applications, quoting Reference S.V. No. 1538, stating age, qualifications, experience and present position should be sent to the Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 16th September, 1961.

F. W. SKELCHER,
Assistant Regional Director.

2223

RHODESIA AND NYASALAND

THE FEDERAL MINISTRY OF EDUCATION invites applications from men under 50 for the following posts at The Polytechnic, Salisbury:—

(1) Lecturer in Electrical Engineering

The successful applicant will be required to teach mainly the syllabus of the Telecommunications Technicians Course of the City and Guilds of London Institute, to organise laboratory facilities and to teach allied subjects as necessary.

The qualifications for this post are a Degree in Physics or Electrical Engineering or Corporate Membership of the Institution of Electrical Engineers.

(2) Assistant Lecturer in Electrical Engineering (Three posts)

The successful applicants will be required to teach craft level courses in Electrical Installations and Electrical Fitting.

Applicants should hold a Higher National Certificate or equivalent. Knowledge of Automobile Electrics would be an advantage.

(3) Lecturer in Chemistry, Mathematics and Physics (Three posts)

The successful applicants will be required to teach to Intermediate level in Chemistry and/or University level in Mathematics and Physics, and organise laboratories. The qualifications for these posts are a good Honours Degree in Physics, Mathematics or Chemistry.

Some commercial or engineering experience is desirable.

Candidates need not necessarily have previous teaching experience, but this would be an advantage.

SALARY SCALES.

Assistant Lecturer £967 10s. × £53 15s. to £1,075 × £107 10s. to £1,290 × £53 15s. to £1,827 10s. Up to six increments are allowed for experience.

Lecturer £1,558 15s. × £53 15s. to £1,935. Up to four increments are allowed for industrial and/or teaching experience over and above that required as a qualification for entry.

Appointments will be made with effect from 1st January, 1962. Service is permanent and pensionable. Passages to the Federation are paid for the officer appointed, his wife and dependent children under 18.

Accommodation is not provided, but there is no difficulty in obtaining it privately in Salisbury. Facilities for the education of children are good. and the climate is agreeable.

Further information and forms of application may be obtained from the Education Liaison Officer, Rhodesia House, 429, Strand, London, W.C.2. The closing date for applications will be 22nd September, 1961.

2240

Situations Vacant (continued)

Eastern Electricity

Essex Sub-Area

SOUTHEND DISTRICT

FOREMAN, APPARATUS REPAIR DEPARTMENT (173/61.R). Applicants should be craftsmen skilled in the repair and reconditioning of all classes of domestic and commercial electrical apparatus, reconditioning of cooker hotplates, tinning, welding, brazing and spray painting, and should be able to supervise and direct a large staff employed in this work.

Rate of pay N.J.I.C. Grade 2, Schedule E, £795 per annum.

Apply by letter to W. E. Wardrop, Assoc.I.E.E., Commercial Officer, Eastern Electricity Board, 81/85, High Street, Brentwood, Essex, by 22nd September, 1961.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT

SENIOR DEMONSTRATOR (191/61.R). Applicants should have had a sound training in domestic science and hold a recognised diploma. They should be capable of arranging and giving talks on domestic electrical subjects to women's organisations, school authorities and groups of students.

The duties of the post will include the supervision of staff as necessary and to assist in building the domestic load by studying new housecraft techniques and new electrical appliances, and by helping housewives directly and indirectly to select, buy and use efficiently the appliances most suited to their needs.

Salary N.J.C.2, £700-£775.

Apply by letter to the Manager, Great Yarmouth District, Eastern Electricity Board, Electric House, Regent Road, Great Yarmouth, Norfolk, by 22nd September, 1961.

THIRD ASSISTANT ENGINEER, AREA METER TESTING STATION, NORWICH (192/61.N). Applicants should possess technical qualifications to Higher National Certificate standard and should have a sound experience of modern repair techniques for all makes and types of meters, including prepayment meters. They should also have had experience in supervising the testing of single-phase meters.

Duties will include the supervision and control of the repair section at the Norwich Meter Testing Station, which deals with all types of single and three-phase meters, time switches and instruments.

Salary N.J.B. Class K, Grade 11, £1,040-£1,165.

Apply by letter to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4, Duke Street, Norwich, Norfolk, NOR. 23A, by 22nd September, 1961.

2248

ELECTRICAL MACHINE DESIGNER

required for manufacturers in S.W. Lancs. H.N. Certificate minimum. Should be familiar with detail design of all types of A.C. and D.C. machines and electro-magnetic equipment.

Progressive post with contributory superannuation scheme after qualifying period.

State age, qualifications, previous experience and salary required. All applications in strict confidence. — Box S.959, Lee & Nightingale, Liverpool, 2.

158

ROLLS-ROYCE

HAVE A VACANCY FOR A

PLANT SUPERINTENDENT

for the operation and maintenance of a large electro-mechanical plant used for altitude testing of aero gas-turbine engines at Derby.

The facility comprises six 20,000 H.P. motor compressor sets, cooling and regeneration turbines, large heat exchangers, refrigeration plant, cooling towers, electro-hydraulic and pneumatic control systems and other ancillary services. The total installed H.P. is 150,000 with a supply voltage of 33,000 v.

Only Chartered Electrical Engineers with considerable experience of similar plant should apply. The post carries a high degree of responsibility and the starting salary will be not less than £1,750 per annum.

Candidates should write for an application form to the:—

Manager, Technical Administration, Rolls-Royce Limited, P.O. Box 31, Derby

2199

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

Vacancy Notice No. 237/61

Dungeness Nuclear Power Station

APPLICATIONS are invited for the undermentioned appointments at Dungeness Nuclear Power Station.

(a) OPERATION SUPERINTENDENT.

The successful applicant will be responsible for the safe and economic operation of the plant in accordance with laid down policy, and for liaison with other departmental heads and specialists. He will be responsible for the training of all operational personnel and the implementation of the appropriate safety rules. Candidates should have experience of the operation and management of modern power stations and of the control of labour. Experience of the commissioning of new plant would be considered an advantage.

Applicants should preferably be qualified to degree standard or its equivalent.

Experience of the operation of nuclear power stations is not essential as adequate training can be given to the successful candidate.

The salary will be in accordance with the National Joint Board Agreement, Schedule A, Class N, Grade 4, £2,050 to £2,235 per annum.

(b) MAINTENANCE SUPERINTENDENT.

The successful applicant will be responsible for the complete maintenance of the station in accordance with laid down policy. He will be responsible for the training of personnel in the Maintenance Department and for liaison with other departmental heads.

Applicants should have wide experience in the administration of a maintenance section, the control of labour and the maintenance of power station plant.

Applicants should preferably be qualified to degree standard or its equivalent. Experience of the operation and maintenance of nuclear power stations is not essential as adequate training can be given to the successful candidate.

The salary will be in accordance with the National Joint Board Agreement, Schedule A, Class N, Grade 4, £2,050 to £2,235 per annum.

Applications stating age, experience, qualifications, etc., should be addressed to the Personnel Officer, Central Electricity Generating Board, South Thames Division, Lower Ham Road, Kingston-upon-Thames, by the 27th September, 1961.

2247

TRANSFORMERS (WATFORD) LTD.

require, due to expansion,

Senior and Junior Draughtsmen

experienced on power and distribution transformers. Good salary plus production bonus. Non-contributory pensions scheme. Excellent working conditions.

Apply, with full particulars, Chief Draughtsman, Transformers (Watford) Ltd., Sandown Road, Watford, Herts.

2043

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the post of SUB-AREA MANAGER in each of the following :—

No. 3 (Sheffield) Sub-Area (E.10 £3,765/£4,020 per annum)

No. 2 (Huddersfield) Sub-Area (C.10 £3,270/£3,515 per annum)

No. 7 (Grimsby) Sub-Area (B.10 £3,040/£3,270 per annum)

Applicants, who should have extensive knowledge of the industry and a wide experience in the organisation of large units of electricity supply, should state age and full details of qualifications and experience and should also indicate the appointment or appointments for which they wish to be considered.

Applications should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Leeds, not later than Friday, 29th September, 1961.

2222

IT ALL ADDS UP! —

KDF9★
KDP10★
DEUCE★
CAREER

—IN MORE WAYS THAN ONE!

This is a problem in conventional decimal addition

COMMON SENSE AND LOGIC

will solve it — and problems in Data Processing

SUCH ATTRIBUTES ARE SCARCE

Possession of them will enable you to solve the problem

HAVE YOU GOT THEM?

If so, please send your solutions to the following address and you will hear further from us:

Data Processing Division, Room ER316C
English Electric Co. Ltd., Stoke-on-Trent, Staffs.

★ *These are Computers by*

'ENGLISH ELECTRIC'

2197

CENTRAL ELECTRICITY GENERATING BOARD

Southern Project Group

Dungeness Nuclear Power Station

APPLICATIONS are invited from suitably qualified and experienced engineers for the post of SECOND ASSISTANT ENGINEER (Mechanical) at Dungeness Nuclear Power Station Construction Site.

The successful candidate will be required to assist the Site Mechanical Engineer in the supervision of the installation and testing of mechanical engineering plant—conventional and nuclear. Experience in the supervision of construction of major engineering works and in the installation of power station plant would be an advantage.

The salary will be within Scale 15 of the National Joint Board Agreement, i.e., £1,460 to £1,830 per annum, according to qualifications and experience.

The successful candidate will be required to live in the vicinity of the site for the duration of the construction work, which will be up to four to five years. Opportunities will be available for transfer to future construction sites and associated project teams.

Applications stating age, qualifications, experience, present position and salary should be forwarded to the Administration Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane, Finchley, London, N.3, to arrive not later than Thursday, 21st September, 1961. Envelopes should be marked "Confidential, Ref. S/61/23."

T. YULE,
Chief Project Engineer.

2254

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. Schedule "A" appointments :—

ASSISTANT SHIFT CONTROL ENGINEER, USKMOUTH "A" & "B" WEST NASH, Nr. NEWPORT, MON. POWER STATIONS. (Vacancy No. 255/ER/61).

Salary Class M, Grade 12, Scale 9, £1,115-£1,245 per annum, plus 10% shift allowance.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

SECOND ASSISTANT ENGINEER (Operation), GENERATION DEPARTMENT, DIVISIONAL HEADQUARTERS, CARDIFF (Vacancy No. 256/ER/61).

Salary Class J, Grade 5, Scale 13, £1,395-£1,610 per annum.

Applicants should possess a Higher National Certificate or equivalent qualification and should have had experience of generating plant maintenance, including the programming of plant overhauls.

Special application forms obtainable from Divisional Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 23rd September, 1961.

2250

Readvertisement

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a SENIOR ASSISTANT ENGINEER in the PLANNING AND ECONOMICS SECTION of the Chief Commercial Officer's Department.

The duties will include commercial studies on generation economics, supervision of programmes of utilisation research and the statistical analyses of the data, and the design of bulk supply and retail tariffs.

Applicants should have had experience in the generation and/or distribution sides of an electricity supply organisation, and Corporate Membership of either the Institution of Electrical Engineers or the Institution of Mechanical Engineers is desirable.

Salary N.J.B. Class K, Grade 3, £1,625/£1,950 per annum.

Applications, quoting reference C14/61, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than 26th September, 1961.

2239

WORKING ELECTRICAL FOREMAN REQUIRED

ONLY a man with drive need apply. Applicants willing to travel away from home. Wage will be £17 to £18 per week with generous subsistence allowance and bonus scheme. State age and general experience.—Box 2215.

Situations Vacant (continued)

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT SENIOR COMMERCIAL ASSISTANT (Sales), Central Sussex District. Salary £1,150-£1,240 per annum maximum on N.J.C. 6. Superannuable. The successful applicant will be responsible for sales promotion and publicity and the co-ordination of the four showrooms in the District. His duties will also include the control of showroom stock.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, Electra House, Church Road, Haywards Heath, Sussex, by 18th September, 1961.

ASSISTANT DISTRICT COMMERCIAL ENGINEER, Guildford. Salary £890 × £25 to £1,015 per annum under N.J.B. Class F, Grade 9. Superannuable. Applicants should have had experience in commercial, industrial and domestic development. A good knowledge of heating installations, including floor warming, is necessary.

Applications, quoting ER, on forms from District Manager, SEEBOARD, Woodbridge Road, Guildford, Surrey, by 20th September, 1961.

FITTER (Electrical), Crawley and Horsham District. Wages 5s. 6¾d. per hour for 42-hour 5-day week under N.J.I.C. Agreement. Applicants should be experienced in the erection and maintenance of H.V. and L.V. switchgear and transformers. Subject to certain conditions, housing accommodation may be available at Crawley.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, 50/52, The Broadway, Crawley. Sussex, by 20th September, 1961.

SHOWROOM ASSISTANTS, Croydon and Purley District. Annual salary including London allowance £285 at 16 to £490 at 20, rising to £600, £680 or £740 according to qualifications obtained and ability. Duties will include general showroom work and the advising of consumers on the use of electrical apparatus. The successful applicants may be required to work in any showroom of the Croydon and Purley District. He may also be required to carry out cashier duties.

Applications, quoting ER, and naming two referees, on forms from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 20th September, 1961.

DEMONSTRATOR (Female), Croydon and Purley District. The duties will include conducting demonstrations, sales and advice to consumers on the selection and use of electrical appliances, both at the showrooms and on consumers' premises. Preference will be given to applicants holding the E.A.W. Electrical Housecraft Certificate. Annual salary within the range of £490 at age 21, rising to £605 or £740, including London allowance, according to qualifications and ability.

Applications, quoting ER, and naming two referees, on forms from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 20th September, 1961.

GEORGE WRAY,
Secretary.
2260

ELECTRICAL MACHINE DESIGNER

required for manufacturers in S.W. Lancs. H.N. Certificate minimum. Should be familiar with detail design of all types of A.C. and D.C. machines and electro-magnetic equipment. Progressive post with contributory superannuation scheme after qualifying period.

State age, qualifications, previous experience and salary required. All applications in strict confidence.—Box C.211, Lee & Nightingale, Liverpool, 2.
340

MSL

have been retained to advise on this appointment.

SENIOR DEVELOPMENT ENGINEER

Electrical Machine Design

to undertake a long-term study of commutation and machine design and performance for a well known company in London, using its comprehensive technical and manufacturing resources. As this project develops there will be some travel in the U.K., and occasionally overseas, to advise customers in industry, and he could become a recognised authority. A starting salary not less than £1,800 is intended with bonus and contributory pension schemes: possibilities beyond the immediate purpose of the appointment exist in an expanding concern.

Aged 30 to 40, the successful applicant will have a degree or equivalent in electrical engineering, A.M.I.E.E., and at least four years' responsible design experience with a major constructor of medium to heavy electrical rotating machinery, following a recognised apprenticeship in the same field. Please send brief details in confidence, quoting reference M.4128 to A. Shaw Maclaren.

In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

MANAGEMENT SELECTION LIMITED
17 Stratton Street, London, W.1
2212

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

South Western Region

FOURTH ASSISTANT ENGINEER (Operational Research), GENERATION DEPARTMENT (SEC/3.167).

The work of the section involves investigation of engineering problems at generating stations throughout the Division and the application of specialised techniques in operational research to improve the effective use of plant and manpower.

Candidates should preferably possess an appropriate professional qualification and have had some operating experience in a generating station.

Previous experience in operational research would be an advantage, but it is not essential since opportunities for training will be given.

Salary N.J.B. Class J, Grade 11, £890-£1,090 per annum.

Special application forms (not A.E.6/ACT), obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 20th September, 1961. 2251

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Research Laboratory, Pitlochry

A VACANCY will occur in the near future for an ASSISTANT ENGINEER (Research) having training and experience embracing electronic techniques. The minimum technical qualification is the Higher National Certificate, but a diploma or a degree is preferred.

Salary N.J.B. Class AX, Grade 8, Scale 10 (£1,130-£1,325).

Applications should be made on the standard form, obtainable from the Research Engineer, North of Scotland Hydro-Electric Board, Ferry Road, Pitlochry, Perthshire, to whom they should be returned within 14 days from the appearance of this advertisement.
2263

SOUTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER, EXETER.

Salary within Class G, Grade 9, Salary Scale 7 (£965 to £1,090 per annum) of the N.J.B. Agreement.

The successful candidate will be required to assist generally in planning, operation, maintenance and construction work within the District. He will be employed initially on supervising cable laying and the installation of substation plant, and also be expected to undertake standby duty.

Sound training in the distribution side of the supply industry and experience in operating systems up to 11 kV is essential. Applicants should be competent to supervise labour. Qualifications leading to Corporate Membership of the Institution of Electrical Engineers are desirable, and possession of a current driving licence will be an advantage.

Applications for this post to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, 3, Bedford Street, Exeter. Closing date for receipt of completed applications is 23rd September, 1961.
2255

WILTSHIRE COUNTY COUNCIL

APPLICATIONS are invited for the post of ELECTRICAL ENGINEERING ASSISTANT in the County Architect's Department. Salary A.P.T. III (£960-£1,140).

Applicants must have experience of engineering services in the above and associate fields, in schools and public buildings. Local government experience is not essential.

The appointment will be subject to the National Scheme of Conditions of Service; to the Local Government Superannuation Acts, and to termination by one month's notice in writing by either party.

Applications should be submitted on forms to be obtained from the County Architect. Completed forms, accompanied with the names and addresses of three referees, should be returned to the Clerk of the County Council, County Hall, Trowbridge. by 15th September.
2262

ELECTRICAL ENGINEERS

Graduate or Chartered Electrical Engineers Required

aged not less than 30, for Industrial Group Consulting Service based in Birmingham.

Candidates should be well educated and have had three years' practical training with a large electrical manufacturer in workshops and drawing office.

Experience is desired in factory supply, distribution and utilisation, with ability to design schemes, specify and engineer electrical extensions and new factory installations. Supervision of contractors and negotiations with managements within the Group at Managing Director levels.

In particular, knowledge of variable speed drives, protection, heat treatment, automatic contactor control gear, H.V. and M.V. switchgear would be desirable advantages.

Initiative, drive and personality are as important as technical attributes, and opportunities to transfer within the Group may occur from time to time.

The Group provides for pension scheme, educational benefits, removal allowance, 3 months' subsistence allowance, car mileage allowance, annual pay reviews.

Applications will be treated in confidence and should be forwarded to :—

The Chief Electrical Engineer

T. I. (GROUP SERVICES) LIMITED

72, Cheston Road, Aston, Birmingham, 7

and should be endorsed " ENGINEERS."

2231

AIR MINISTRY

require STATION ENGINEERS ELECTRICAL (GRADE III) to supervise the installation, operation and maintenance of electrical plant at R.A.F. and Ministry of Aviation establishments in the U.K. and at R.A.F. Stations overseas. 5-day week with 18 days' paid leave a year initially.

SALARY, which is dependent on age, quals. and exp., ranges in the U.K. from £776 (age 25) to £961 max. in Grade III. There are pension prospects and also opportunities of advancement to numerous posts in the higher grades, viz.:—

Technical Grade II, £961-£1,098. 280 posts.

Inspector of Works, Grade I, £1,098-£1,348. 140 posts.

Technical Grade B, £1,348-£1,552. 20 posts.

Technical Grade A, £1,439-£1,697. 17 posts.

Vacancies occurring in these higher grades are, as a rule, filled by promotion of existing staff.

OVERSEAS TOURS. Salary £826 (age 25) to £1,014 (max.) plus tax-free foreign service allowance which varies according to location, marital status, etc., and ranges at present up to £1,800 p.a. Expatriation and kit allowances and free passage for self and family when accommodation arranged. Free medical and child education arrangements.

QUALS. AND EXP. Applicants, who must be natural-born British subjects up to age 55, should have served an apprenticeship and hold an O.N.C. or C. and G. Technical Cert. or equiv. Experience is required in one or more of the following :—

Electrical generation.

Electrical distribution, H.T. & L.T.

Electrical installations, industrial & domestic.

Light current and/or electronic engineering.

Internal training courses provided and financial assistance and time off allowed for recognised courses of study leading to higher quals.

Forms from Manager (P.E.I.), Ministry of Labour, Professional and Executive Register. Atlantic House, Farringdon Street, London, E.C.4. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised.

263

ELECTRICAL SAFETY ENGINEER (MAIN GRADE), MINISTRY OF HEALTH

PENSIONABLE post in London for man, normally at least 35 on 1.9.61, who has achieved Corporate Membership of the Institution of Electrical Engineers. Honours degree or Dip.Tech. in Engineering an advantage.

The post demands specialist knowledge of the problems of safety of electrical installations, equipment and apparatus (particularly where inflammable and explosive gases are present) and of the precautions against static electricity. Experience in the electronics field will be an advantage.

Candidates should have had wide and responsible experience of electrical engineering in hospitals or other fields where similar problems arise.

Salary scale (Inner London) £1,516-£2,015. Starting salary may be above minimum. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting **S/5378/61.** Closing date 28th September, 1961.

2242

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

HUDDERSFIELD DISTRICT

CONSUMERS' ENGINEER.

Applicants should be technically trained and have good general experience on utilisation, wiring installations and metering. They should also have experience in the negotiation of supplies and in the application of tariffs for domestic, commercial and industrial purposes.

Salary N.J.B. Class J, Grade 7 (Scale 11), £1,275/£1,410 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 2 (Huddersfield) Sub-Area, Market Street, Huddersfield, not later than 21st September, 1961.

No. 3 (Sheffield) Sub-Area

ROTHERHAM/MEXBOROUGH DISTRICT

SPECIALIST SALES REPRESENTATIVE.

Applicants will be required to give advice to commercial caterers, fish fryers and the like with the object of securing commercial catering and refrigeration load; and to give non-technical assistance to the Assistant Engineer (Consumers) in the development of this load.

The possession of the E.D.A. Salesmanship Certificate will be an advantage.

The successful candidate will normally be located at Rotherham, but will be required to work throughout the District as occasion demands.

Salary N.J.C. Grade 3, £780/£25/£880 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 3 (Sheffield) Sub-Area, Commercial Street, Sheffield, not later than 21st September, 1961.

2259

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYORS required for Manchester and Sheffield districts. Permanent positions carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

2261

A PATENT & INFORMATION OFFICER

is required to combine the duties of administering the company's patent procedures and maintaining a technical library and information service.

The successful candidate is most likely to be a man having at least the H.N.C. in Electrical or Mechanical Engineering, together with a sound knowledge of patent procedures. A knowledge of German and/or French would be a distinct advantage.

This is a permanent appointment and employment benefits include membership of generous non-contributory life assurance and contributory pension schemes.

Please apply, giving the fullest details of qualifications, positions held and salaries, etc., to the Personnel Manager

THE

RHEOSTATIC

COMPANY **LIMITED**

Slough **Bucks**

2200

Situations Vacant (continued)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

Birmingham Area

AREA SECRETARY
(Area Office).

Applicants should have considerable experience of administration in a large undertaking in a responsible senior post, and a good working knowledge of electricity legislation and the national agreements governing rates of pay and conditions of employment of all grades of employees. Duties will also include the provision of all necessary secretarial services, the supervision of education and training and welfare facilities in the Area, the acquisition of property for substations and service centres, wayleaves, and property management generally in a densely developed area. Candidates should possess appropriate professional qualifications. Salary £2,815/£3,040 per annum (N.J.M. Class F, Grade 5).

Applications, stating age, experience, qualifications, present position and salary should be forwarded within 7 days to Emil Braathen, Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

Central Gloucestershire Area

DEMONSTRATOR (Female)
(Dean Forest).

Applicants must have a good education and should have a certificate of a recognised training college and/or the E.A.W. Certificate. Applicants must be prepared to take an active part in the sales organisation, and selling experience would be an advantage. Duties include lecture demonstrations in service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus. Salary £600/£700 per annum (N.J.C. Grade 1).

Apply by letter within 14 days stating age, education, qualifications, training and experience to Mr. S. Raybould, Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

Wolverhampton Area

DEMONSTRATOR (Female)
(Lichfield).

Applicants must have a good education and should have a certificate of a recognised domestic training college and/or the E.A.W. Certificate. Duties include lecture demonstrations in service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus. Salary £600/£700 per annum (N.J.C. Grade 1).

Apply by letter within 14 days stating age, education and qualifications, training and experience to Area Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

F. W. CATER,
Secretary.

2236

ELECTRICAL CONTRACTORS
have the following vacancies:—

ESTIMATOR

SUPERVISOR

Write stating full details of experience.

BROWN AND PARTNERS
124, Livery Street, Birmingham, 3

2217

NORTH WESTERN ELECTRICITY BOARD

Second Assistant Engineer, Design Section, Sub-Area Engineering Dept., Oldham

Applicants should be qualified engineers and have wide experience in the planning and design of modern systems. The duties will mainly consist of the long-term planning and engineering development of major schemes involving 33-kV, 11-kV and 6-kV networks. Preference will be given to applicants who are Corporate Members of the Institution of Electrical Engineers.

Salary scale £1,535/£1,720 p.a., Grade L.6. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him by 30th September, 1961.

Fourth Assistant Engineer, Sub-Area Engineering Dept., Blackburn

Applicants should be experienced in the planning and construction of low, medium and high-voltage overhead and underground systems. Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale £965/£1,090 p.a., Grade L.13. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, and returned to him by 16th September, 1961.

2241

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

Vacancy No. 236/61

Electrical Engineer's Department

ENGINEER required to join a District team engaged in commissioning major electrical plant and maintaining associated automatic protective and control gear in generating stations and transforming substations. This work will be in Kent or Surrey or East Sussex, but the successful candidate will be based in the first instance at Divisional Headquarters, Kingston-upon-Thames.

This post offers good career prospects in an interesting field to recently qualified or other engineers who should possess at least Higher National Certificate in Electrical Engineering or equivalent qualifications.

Salary is £940 to £1,215 per annum (London area), £890 to £1,215 per annum (outside London area). Designation is Fourth Assistant Engineer (Technical). National Joint Board conditions of service.

Applications giving details of age, qualifications, experience, etc., should be sent to the Personnel Officer, Central Electricity Generating Board, Central Electricity House, Lower Ham Road, Kingston-upon-Thames, Surrey, to arrive by 15th September, 1961.

2246

THE ENGLISH ELECTRIC CO. LTD.

FRACTIONAL HORSE POWER MOTOR DIVISION

English Electric invite applications for appointments to the outside sales staff specialising in sale of fractional horse power motors in a number of Branch territories including the London Area.

Qualified engineers already experienced in this field and engineers who feel that they have qualifications which would enable them to succeed in this field are invited to submit details of their experience and training, together with relevant personal data to Mr. G. N. Smith, Dept. G.P.S., English Electric House, Strand, London, W.C.2, quoting reference number ER0097A.

2118

ELECTRICAL OFFICER
ROYAL RESEARCH SHIP "SHACKLETON"

APPLICATIONS are invited for the above post with the FALKLAND ISLANDS DEPENDENCIES SURVEY for one tour of one year in the first instance. Salary £900 a year. Uniform allowance £32. Gratuity £50 at end of each annual commission. Free messing and quarters aboard ship or messing allowance on other occasions.

Candidates, 21-35 years of age, must have experience as ship's electrician. Duties include maintenance of ASEA 5-ton crane, electric windlass and capstan, Decca radar, Browns gyro and Kevin & Hughes sounding machines.

Successful candidate will be required to take up appointment as soon as possible.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51372/EF.

2205

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

ASSISTANT ENGINEER (Relief) is required at Wolverhampton Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E.9, £825-£940 per annum.

The engineer will be expected to carry out shift relief duties to the Shift Charge Engineer and when not so employed will be available to undertake duties in the maintenance and operation departments. The appropriate grade and shift allowance will be paid when relief shift duties are being performed.

Applicants should have received a sound technical training and appropriate qualifications will be an advantage.

Apply quoting Vacancy Number 229/61 MD, on form A.E.6 available from the Station Superintendent, Wolverhampton Power Station, Commercial Road, Wolverhampton, to whom they should be returned when completed not later than 18th September, 1961.

2225

AIR MINISTRY

MAIN Grade and Basic Grade MECHANICAL AND ELECTRICAL ENGINEERS required for design, construction and maintenance of installations on (a) airfields, radar stations, missile bases, workshops and maintenance units for the R.A.F. at home and overseas and (b) certain Civil Airports.

SALARY according to age, quals. and exp. ranges for Main Grade Engineers from £1,456 to £1,950 (max.) and for Basic Grade from £936 (at 25) to £1,430 max., with an increase for London and slight decrease in country districts. In addition basic grade salary is increased by £95 p.a. (within the maximum of the scale) after 2 years' approved service subject to being Corporate Member of Institution of Mechanical or Electrical Engineers. Appointments long term with good prospects of pension and advancement to numerous posts in higher grades, viz.:—

MAIN GRADE MECHANICAL AND ELECTRICAL ENGINEERS, £1,456-£1,950. 125 posts.

SENIOR MECHANICAL AND ELECTRICAL ENGINEERS, £2,080-£2,392. 34 posts.

SUPERINTENDING MECHANICAL & ELECTRICAL ENGINEERS, £2,650 upwards. 9 posts.

Vacancies occurring in these higher grades are, as a rule, filled by promotion of existing staff.

Good opportunities for acquiring experience overseas where special allowances ranging at present up to £1,800 p.a. according to location and marital status are payable in addition to a higher salary. 5-day week with 4 weeks 2 days paid leave p.a. initially.

QUALS.

(a) Graduate (for Basic Grade) or Corporate (for Main Grade) Membership of I.E.E. or I.Mech.E. (with appreciable electrical engineering experience) with at least 3 years' apprenticeship; or

(b) University degree (honours for Main Grade) or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship.

In addition all candidates should have been employed for minimum of 2 years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural-born British subjects and, for basic grade posts, between ages 25 and 35. Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.128/1A. Selection will be by interview in London and certain expenses will be reimbursed.

260

TO ALL ELECTRICAL DESIGN ENGINEERS AND DRAUGHTSMEN

WE are shortly moving into a new modern office building and have vacancies for DESIGN ENGINEERS and DRAUGHTSMEN who are interested in installation design in all classes of industrial and commercial buildings, including

AIRPORTS	NEW HOSPITALS
HOTELS	OFFICE BLOCKS
UNIVERSITIES	SCHOOLS

both at home and abroad.

Spring and summer holidays, pension scheme and luncheon vouchers.

Apply in writing stating age, experience, qualifications, present salary and salary required to :—

J. ROGER PRESTON & PARTNERS
15, North Audley Street
London, W.1

2149

PORT OF LONDON AUTHORITY

invite applications for the position of

ASSISTANT ENGINEERING INSPECTOR (Electrical)

on their Established Pensionable Staff at London and St. Katharine Docks, E.1.

Salary scale £950 per annum rising by annual increments to £1,045 per annum. Commencing rate according to experience.

Applicants, who should be under 50 years of age, should possess a sound knowledge of the principles of both high-voltage and low-voltage distribution, including switchgear, transformers, cables, pumps, rectifiers and associated protection and automatic controls. Experience in handling a skilled labour force is also desirable.

Applications, giving age and full details of experience, should be addressed to the

Establishment Officer
PORT OF LONDON AUTHORITY
P.O. Box No. 242, London, E.C.3

2213

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

APPLICATIONS are invited from suitably qualified engineers for the following appointments in the Technical Branch of the Regional Electrical Department.

1. One THIRD ASSISTANT ENGINEER (Protection), Grade 8, Class K (£1,145-£1,410 per annum), based on Leeds (Test Laboratory), to undertake testing of complete protective equipments and components and investigate problems arising on equipment in service.

2. Three FOURTH ASSISTANT ENGINEERS (Protection), Grade 11, Class K (£900-£1,165 per annum), based on Leeds (Test Laboratory), to assist with the work described under Vacancy (1).

3. One THIRD ASSISTANT ENGINEER (Protection), Grade 8, Class K (£1,145-£1,410 per annum), based on Leeds (Design Section), to undertake the checking of schematic diagrams, wiring diagrams and specifications for protective and control gear and associated apparatus. Site commissioning experience would be an advantage.

4. Three FOURTH ASSISTANT ENGINEERS (Protection), Grade 10 or 11, Class K (£980 - £1,245 or £900 - £1,165 per annum), based on Leeds (Design Section), to assist with the work described under Vacancy (3).

5. Five FOURTH ASSISTANT ENGINEERS (Protection), Grade 11, Class K (£900-£1,165 per annum), based on North Tees (2), Leeds, Wakefield and Keadby, to assist with testing and commissioning of generators, transformers, switchgear, lines and cables and with the testing, commissioning and maintenance of protective gear and control and indicating equipment for switchgear and transformers.

In all cases experience in a switchgear manufacturer's works would be an advantage.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 22nd September, 1961.

2183

JAMES BOOTH ALUMINIUM LIMITED

have immediate vacancies for:

JUNIOR ELECTRICAL ENGINEERS, having H.N.C. or Grad.I.E.E. as minimum qualifications, with experience either of heavy rolling mill drives or of factory distribution systems including 11 kV equipment and conversant with schematic diagrams and contractor equipment.

ELECTRICAL DRAUGHTSMEN, having O.N.C. as minimum qualification, with experience of installation and distribution drawings and capable of developing schemes from schematic diagrams.

Apply with full details, etc.:

The Engineering Director, James Booth Aluminium Limited, Argyle Street, Nechells, Birmingham, 7

2134

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

Second Assistant Engineer (Operational Research)

APPLICATIONS are invited for the above appointment in the Operational Research Department of the North Eastern Region of the Central Electricity Generating Board, Leeds.

The applicants should have good engineering qualifications, some experience in power station work, and be capable of original and constructive thought.

The successful applicant will be required to continue the work of the department on the application of work study principles to the problem of the quick return to service of high-merit units following overhaul. He will also, to a lesser extent, be required to co-operate in the work of the department on the application of operational research techniques to the Board's power stations.

The salary according to experience and qualifications will be within the range of £1,415 to £1,720 per annum, National Joint Board Agreement, Grade 5, Class BX, Scale 14.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 25th September, 1961.

2249

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

APPLICATIONS are invited for the following appointments at the PORTISHEAD "B" POWER STATION, PORTISHEAD, SOMERSET.

FITTERS—ELECTRICAL AND INSTRUMENT MECHANICS

Applicants should have served a recognised course of training or apprenticeship and, for the Instrument Mechanics position, have had experience in the maintenance of recording and indicating instruments, automatic boiler control equipment and turbovisory gear as installed in modern power station plant would be an advantage.

Rate of pay is 5s. 6¾d. per hour. Canteen facilities.

The conditions of service will be in accordance with the N.J.I.C. Agreement for the Electricity Supply Industry, and good sick pay and holiday schemes are in operation together with a voluntary superannuation scheme.

Application should be made on form A.E.6/M, obtainable from the Station Superintendent, Portishead Power Station, Portishead, Somerset, and should be returned to him by 18th October, 1961.

2272

SENIOR TRANSFORMER DESIGNER

with experience of various types up to 5 MVA. This appointment carries a very realistic salary and scope for the future for the right man between 30-40.

A company house is available if required. Factory is situated in ideal rural surroundings four miles from the sea.

Apply Chief Designer, London Transformer Products Ltd., Bridgend, Glam.

206

INTERNATIONAL ELECTROTECHNICAL COMMISSION

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION, a non-governmental international organisation with its seat in Geneva, devoted to the standardisation of electrical equipment, wishes to engage for entry on 1st January, 1962 :—

TECHNICAL TRANSLATOR/EDITOR

DUTIES.

(1) Translation from French into English of texts dealing with all branches of electrical engineering.
(2) Editing of technical texts.

REQUIREMENTS.

(1) English mother-tongue.
(2) Experience as technical translator in electrical subjects.
(3) Age 25 to 35 years.
(4) Preference will be given to candidates having a university degree or having been trained in a recognised interpreters' school.

CONDITIONS.

Starting salary according to age and experience. Trial engagement of one year. There is a contributory pension fund.

Applications should be sent to the General Secretary, I.E.C., 1, rue de Varembé, Geneva, with curriculum vitæ. Interviews can be arranged in London in mid-November, 1961.

2257

CONTROL ENGINEERS

AN expanding organisation in the West Midlands area engaged in the manufacture of electric control gear and electronic equipment has the following vacancies:—

MANAGER SALES/ESTIMATING DEPARTMENT

Applicants must possess drive and organising ability and have experience in the field of control gear engineering.

SALES ESTIMATING ENGINEERS

for the preparation of tenders for automatic schemes of control.

In both appointments there is considerable scope for advancement in a growing group of companies. Interview expenses and removal expenses met as appropriate.

Write to Box 2196, giving details of age, education and experience. All replies will be treated in strict confidence.

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

ASSISTANT ENGINEER (Control Room), LEICESTER POWER STATION (Vacancy No. 205/61).

Applications are invited for the position of Assistant Engineer (Control Room) at Leicester Power Station, Rawdykes Road, Leicester. Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class G, Grade 13 (£715 - £805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications, 15th September, 1961.

This appointment is pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,
Assistant Regional Director.

2253

HOME OFFICE: WIRELESS TECHNICIANS

15 PENSIONABLE posts for men at least 21 on 1.7.61, with sound theoretical and practical knowledge of wireless engineering and wireless communications equipment, including V.H.F. apparatus, and experience in radio and radio service work. Ability to drive private and commercial vehicles desirable.

Starting salary (National) £690 (at 21) to £810 (at 25 or over). Scale maximum £930. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting **S/5362/61.** Closing date 10th October, 1961.

2243

TESTERS

SENIOR and JUNIOR ELECTRICAL TESTERS required. For the senior position testing experience of transformers and qualifications to O.N.C. essential, and for junior a good electrical engineering background.

Apply Chief Engineer, Power Division, Gresham Lion Group Limited, Twickenham Road, Hanworth, Middlesex.

2233

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class J, Grade 9 (£1,115-£1,245 per annum). N.J.B. conditions of service.

The successful candidate will be required to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution, and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1401, not later than 18th September, 1961.

2256

ELECTRICAL SALES ENGINEER

(A.M.I.E.E. at least)

A NEW appointment to promote the use of aluminium foil and strip in transformer and magnet windings, as well as other applications, requires a man over thirty years of age with sales experience and a knowledge of winding designs.

The appointment, which offers plenty of scope, is based on London. Right salary will be paid for the right man.—Box 2216.

NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited from suitably qualified engineers for the appointment of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Darlington. Applicants should have experience in the utilisation of electrical energy in commercial and domestic premises, a knowledge of installation work, and be conversant with tariffs, sales and all aspects of consumers' service.

Salary Schedule A, Class G, Grade 5, £1,275/£1,410 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement.

2258

Due to expansion the

CONTROL GEAR DIVISION

of

G.W.B. FURNACES LTD.

require additional

ELECTRICAL ESTIMATORS

at their Dudley Works. Applicants must be capable of analysing customers' requirements, preparing circuit diagrams and composite tenders. No electronics involved. Technical qualifications to H.N.C. standard preferred. Possibility of eventual promotion to outside sales staff for men of the right personality.

The works are situated in pleasant surroundings, and assistance with removal expenses will be given in approved cases.

Detailed applications, in confidence, which will be acknowledged, to Sales Manager, Control Gear Division, G.W.B. Furnaces Limited, P.O. Box No. 4, Dibdale Works, Dudley, Worcs.

2202

CITY OF LIVERPOOL EDUCATION COMMITTEE

College of Technology

Principal: S. A. J. Parsons, B.Sc.(Econ.), M.I.Mech.E., M.I.Prod.E., M.B.I.M.

LECTURER IN ELECTRICAL ENGINEERING required. Salary £1,370 × £35 to £1,550 per annum (Burnham Scale). Commencing salary assessed according to previous industrial or professional experience.

University degree required. Corporate Membership of the I.E.E. an added qualification. Industrial and/or research and teaching experience essential. Applicants should be capable of teaching any two of the following subjects to H.N.C. and Diploma level: Electrical Power Supply, Utilisation of Electrical Plant, Electrical Machines, and to assist in the organisation of postgraduate courses. Research work will be encouraged.

Further particulars and application form (returnable by 18th September, 1961) from the Director of Education, 14, Sir Thomas Street, Liverpool, 1.

THOMAS ALKER,
Town Clerk.

(J.6979) 2201

CHIEF TEST AND INSPECTION ENGINEER

GRESHAM TRANSFORMERS Ltd., Twickenham Road, Hanworth, Middlesex, have a vacancy for a CHIEF TEST & INSPECTION ENGINEER.

The successful applicant will be responsible to the Chief Engineer for all testing and inspection of power transformers up to 5 MVA, and an extensive range of special equipments, including transductors, welding transformers, static rectifier sets and voltage regulators. The testing work includes type tests such as impulse and noise tests, and all experimental and development testing.

The position demands an educational level up to Higher National Certificate, with experience of transformer manufacture and testing, also the ability to supervise and train personnel, and to deal with customers at the inspection and testing stage.

Applicants should write, giving full particulars, to the Chief Engineer, at the above address.

2232

BRITISH INSULATED CALLENDER'S (SUBMARINE CABLES) LTD.

require an ELECTRICAL ENGINEER to undertake development work on submarine power cables and accessories. The selected candidate will be required to organise and progress the development work up to production against customers' requirements.

Applicants should hold an Engineering Degree, H.N.C. or its equivalent, and preferably have a knowledge of power cable design and manufacture.

Staff pension scheme. Canteen and social club facilities.

Applications should be addressed to the Secretary, British Insulated Callender's (Submarine Cables) Ltd., Trafford Park, Manchester, 17.

2135

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

SHIFT CHARGE ENGINEER required at Ocker Hill Power Station, Tipton, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade G.7, £1,115-£1,245 per annum, plus 10% shift allowance.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear are required. Appropriate qualifications desirable.

Apply, quoting Vacancy Number 232/61 MD, on form A.E.6 available from the Station Superintendent, Ocker Hill Power Station, Bayley's Lane, Tipton, Staffs, by 18th September, 1961.

2224

RESIDENT SALES ENGINEER for IRAN

OLD ESTABLISHED CONTINENTAL MANUFACTURERS OF ROTATING ELECTRICAL MACHINERY, REQUIRE SALES ENGINEER FOR TEHERAN OFFICE, FOLLOWING INSTRUCTION PERIOD AT WORKS.

LUCRATIVE POSITION WITH EXCELLENT PROSPECTS.

WRITE FOR PRELIMINARY INTERVIEW IN LONDON.

Box 2198

ELECTRICAL ENGINEERS
INSTALLATION DESIGN WORK

ENGINEERS wanted by Consulting Engineers with expanding practice for Croydon office. Salary £1,000 to £1,300 p.a., governed by qualifications and experience. Good prospects.

Write giving details of experience to Barlow, Leslie & Coombes, 5, Catherine Place, London, S.W.1.

2214

TRANSFORMERS & RECTIFIERS LTD.

Millmead, Guildford

require a

SENIOR TRANSFORMER DESIGNER

for work on all types up to 1,000 kVA. The company is expanding and the position carries excellent prospects for the right man. Some experience of saturable reactors an advantage.

Evening and Saturday morning interviews can be arranged and replies treated in strict confidence. Some housing assistance could be arranged if necessary.

2234

INSPECTORS OF WORKS (ELECTRICAL)

required by KENYA GOVERNMENT for 2 tours of 24/27 months in first instance. Salary according to age and experience in scale (including inducement pay) rising to £1,473 a year. Gratuity 25% of total salary drawn. Children's education allowances. Outfit allowance £40. Free passages. Liberal leave on full salary.

Candidates, under 45 years of age, must have served full apprenticeship and have had 5 years' subsequent experience in the service of a substantial industrial or contracting business organisation.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51133/EF.

2204

HEATING, ELECTRICAL SANITARY AND INDUSTRIAL ENGINEERS

TECHNICAL SALES EXECUTIVE

HEATING, Mechanical or Electrical Engineer with ability to promote business with architects and industrialists is required for our London area office.

The position requires extensive knowledge of the mechanical contracting and sub-contracting industries, and demands considerable initiative, determination, and administrative ability.

The post carries executive rank and provides opportunity for advancement. A car will be provided.

Send fullest particulars of education, training, experience and age, addressing your application for the attention of the Branch Manager, Scull Associated Companies, Finwell House, 26, Finsbury Square, London, E.C.2.

2227

CLASSIFIED ADVERTISEMENTS ARE PREPAID

Situations Vacant (continued)

WORKS MANAGER

Bermondsey, S.E. London

REMPLOY Ltd. is extending its activities in the development and production of tubular sheathed elements for domestic electrical appliances and requires the services of a first-class technician to control manufacturing processes at its Bermondsey factory.

Applicants must have had previous tool room experience, possess an up-to-date knowledge of the manufacturing of domestic electrical equipment and have the ability to maintain good labour relationships.

Applications giving full particulars of qualifications and experience, and stating minimum salary requirements should be addressed to Appointments Officer (P.A. 14), Remploy Limited, 415, Edgware Road, London, N.W.2. 2235

NUCLEAR CHEMICAL PLANT LTD.

require an

ASSISTANT ELECTRICAL DESIGN ENGINEER

with H.N.C. Electrical minimum qualifications. Duties will include the preparation of basic schemes for power distribution, lighting, motor control, process heating and electrical control systems, and the production with the aid of draughting staff of working drawings and specifications for novel chemical plant installations. Experience in estimating and supervision of installation work would be advantageous.

Good salary and working conditions. Pension scheme.

Apply giving brief details to Nuclear Chemical Plant Ltd., 105-113, The Broadway, West Ealing, London, W.13. 2226

SOUTH OF SCOTLAND ELECTRICITY BOARD

Showroom Manager

APPLICATIONS are invited for the position of SHOWROOM MANAGER of a large showroom to be opened shortly in Glasgow.

Applicants must have a thorough knowledge of modern sales methods and techniques; a wide and successful experience in retail selling; be capable of controlling a large staff, and must have adequate personal drive and energy. Experience in the electrical industry would be an advantage, but not essential.

Salary £1,530/£1,650 per annum. Superannuable.

Apply giving age, experience, etc., and quoting reference No. C.15/61, to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than 22nd September, 1961. 2238

APPLICATIONS are invited by Kennedy & Donkin, 12, Caxton Street, London, S.W.1 (ref. RFL), for the post of assistant in the cable department at their Weybridge office. Applicants must be qualified electrical engineers with experience in design, manufacture and installation of cables for transmission and generation projects. 341

CONSULTING engineers require an experienced electrical engineer to assist in supervision of erection, testing and commissioning of large hydro-electric power project in North Wales. Candidates should preferably have an engineering degree or at least H.N.C. Candidates should submit full details of training and experience to—Kennedy & Donkin, 12, Caxton Street, London, S.W.1. 2266

CONSULTING ENGINEERS

require the services of

ELECTRICAL CONTRACT ENGINEERS

with experience of overhead line distribution and substation work up to 132 kV. Corporate Members of I.E.E. preferred, but minimum qualification of H.N.C. associated with good experience will be considered.

Salary in accordance with qualifications and experience. Bonus and pension schemes.

Applications, giving full details of age, qualifications and experience to be made in writing within fourteen days to Preece, Cardew & Rider, 8-12, Queen Anne's Gate, Westminster, London, S.W.1. 2203

APPLICATIONS are invited for the appointment of a junior electrical engineering assistant. Applicants, preferably having served an apprenticeship at a manufacturer's works, should be Graduate Members of the I.E.E. and have had considerable experience in the installation and operation of light and heavy electrical equipment. Knowledge of radio an advantage. Applications giving full details of age, experience, etc., and salary required should be addressed to—Engineer-in-Chief, The South Staffordshire Waterworks Company, 50, Sheepcote Street, Birmingham, 15. 2164

CENTRAL London wholesalers require experienced representative. Must be car owner. Salary, commission, car allowance.—Box 2228.

CONSULTING engineers require an experienced electrical engineer at their Weybridge office to assist in design and contract work associated with large hydro-electric power project. Candidates should preferably have an engineering degree or at least H.N.C. Candidates should submit full details of training and experience to—Kennedy & Donkin, 12, Caxton Street, London, S.W.1. 2267

CONTRACTORS, senior and assistant engineers required by well-established firm, central London, for quality work of all types. Positions offer scope for advancement for capable and energetic engineers. Write fullest detail, in confidence, of experience, training, age and salary required.—Box 133.

CONTRACTORS N.W. Lond. require experienced cost accounts clerk for interim valuations and preparation of final accounts. This is a senior appointment offering good salary, pension and housing facilities. Only those with similar experience should apply. Write full details—J. W. Russell Limited, 18, Queens Road, Watford. 2195

EAST Africa. Assistant engineer required; must be experienced in estimating and supervision for electrical contracts of all types and values. Write giving full details to—Box 2143.

ELECTRIC lamp manufacturer requires experienced lampmaker for position of responsibility. Full details of education, experience, age in confidence, to—Box 8329.

ELECTRICAL engineer, young, with interest in sales aspects, required for plant sales office of manufacturer of electric arc welding equipment. Apply (Ref. S), Murex Welding Processes Ltd., Hertford Rd., Waltham Cross, Herts. 2062

ELECTRICAL estimating engineer, age preferred 25-30 yrs., experienced in preparation of lighting and power tenders with ability to accept responsibility of progressing work. Apply first in writing, stating education, experience, etc., to — Elequip Ltd., 106, London Road, Leicester. 2268

ELECTRICAL firm with attractive retail showrooms and small contracting business of good standing requires capable practical man with high standards of service to take charge of dept. N.W. London. Able to drive. Good position and prospects for keen man. State age and details of career.—Box 8331.

EXPANDING electrical repair company requires for their East London works fully skilled foremen for large armature winding department, and small motor and portable tool department; also works clerk. All applications treated in the strictest confidence.—Box 2064.

EXPERIENCED servicing engineer required by a medium-sized engineering co. in N.W. London to service and maintain electric vehicles (including I.T.D. and conveyancer fork-lift trucks). Good wages, canteen, pension scheme. Apply to the Employment Officer, E.N.V. Engineering Co. Ltd., Hythe Road, Willesden, London, N.W.10. 2206

FULLY experienced journeyman cable jointers required by large electrical company. Applicants would be required to travel to any part of the country. London rates of pay and out allowance. Write stating age and giving brief details of experience to—Box 2244.

MAGNETIC amplifier type automatic voltage and speed regulators for alternators and motors. Electronic engineer required for design. Knowledge of machine characteristics considered an advantage. State by letter age, qualifications and experience to—W. Mackie & Co. Ltd., 129/133, Lambeth Road, London, S.E.1. 2207

MECHANICAL fitter/assemblers required for assembly of medium and large size on-load tap changers for transformers. High piecework earnings possible. Apply personally or in writing to the Works Employment Officer, Fuller Electric Ltd., Fulbourne Road, Walthamstow, London, E.17 (LAR. 2350). 2076

SALES estimating engineer required by expanding firm of electric motor control gear manufacturers. Knowledge of contactors and relays desirable. Salary according to age and qualifications. Pension scheme, canteen, five-day week. Write giving brief details to—Sales Director, E. N. Bray Ltd., Britannia Road, Waltham Cross, Herts. 2245

SENIOR electrical layout draughtsman required for consulting engineer's office. Experienced in electrical equipment for buildings, etc. Salary £1,050 upwards according to experience; permanency, pension fund, etc.—C. W. Glover & Partners, Consulting Engineers, Francis House, Francis St., London S.W.1. 2146

SENIOR laboratory assistant (preferably under 30) to be responsible for photometric and thermometric work on lighting fittings and associated problems. Work includes interesting development of techniques and apparatus allied to design of lighting fittings. Knowledge of glass, plastics, electrical circuitry and fundamental problems of vision in artificial light would be helpful. Some personal contact with clients, technical associations and manufacturers will be necessary. Company pension scheme. Salary according to ability and experience (Dip. Member of I.E.S. would be an advantage). Apply fully, marking envelope "Confidential," to—Technical Director, Holophane Ltd., Scientific Illuminating Engineers, Elverton Street, Westminster, London, S.W.1. 2065

SOUTH WALES SWITCHGEAR Limited have vacancy for experienced designer for medium-voltage air circuit breakers. This position offers considerable scope for ambitious engineer. Apply giving particulars of experience, etc., to the General Manager, South Wales Switchgear Limited, Blackwood, Monmouthshire. 2218

TECHNICAL sales engineers required by expanding firm of electrical motor and gearbox manufacturers for East Midlands and for East Anglia.—Box 2128.

WINDING shop foreman, age 35/40, for modern Midlands repair works. Attractive salary and conditions. Experienced in winding and coil making for large A.C./D.C. machines and H.V. transformers. Apply stating age, apprenticeship, training, present position, earnings and conditions.—Box 2129.

SITUATIONS WANTED

A.M.I.E.E. (47), medium/light engineering, seeks responsible post following merger and miscasting in reshuffle. Sales manager ten years. Sound record, able administrator, loyal, hard worker. Assured excellent references. Min. starting £1,500.—Box 8327.

CHARTERED electrical engineer, 10 years consulting at home and abroad, desires responsible position. Excellent references.—Box 8320.

ELECTRICAL engineer desires senior sales appointment. Considerable experience switchgear and motor controls. Competent negotiator. Widely connected.—Box 8330.

ELECTRICAL engineer with transformer design experience will consider change. Apply—Box 8325.

ARTICLES FOR SALE

600

750-h.p. ROLLING MILL MOTOR by BROWN BOVERI, wound for 2,200 volts, 3-phase, 50 cycles supply, speed 146 r.p.m., 0.75 power factor, continuously rated, suitable for reversing on load if required. Mounted on baseplate with two pedestal ring oil-lubricated bearings.

FOUR 400-h.p. ROLLING MILL MOTORS by the ENGLISH ELECTRIC Co., wound for 400 volts, 3-phase, 50 cycles supply, speed 738 r.p.m., coupled to gearbox giving final 30 r.p.m. With barring motor and control gear.

150-kW, 520-volt D.C. MERCURY ARC RECTIFIER by BRUCE PEEBLES, 289 amps. continuous duty, 361 amps. for two hours. In sheet steel cubicle, with voltmeter 0/700, ammeter. Complete with spare glass bulb and transformer, primary 3,300 volts.

GEORGE COHEN
Sons & Co. Ltd.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070)
Stanningley, Nr. Leeds
(Tel. Pudsey 2241)
Cogan St., Pollokshaws, Glasgow, S.3
339

MOTOR CONVERTERS FOR SALE

2 Serviceable BRUCE PEEBLES Motor Converters, 6,000/6,400 volt, 500 r.p.m., 50 cycles, 3-phase, A.C. 460/400 volt, 500 kW, 1,200/1,150 amps. D.C. (manufactured prior 1936).

Forms of tender can be obtained from the Manager, Merseyside and North Wales Electricity Board, No. 2 Sub-Area, Sandiway House, Northwich, Cheshire.

2229

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W.4. 57

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 600 kVA.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

ALTERNATORS for sale from 1,000 kVA at 750 r.p.m. down to ½ kVA. Single and three-phase. All voltages. More than 150 machines in stock. Automatic regulators and switchboards available.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, armoured, P.I.L.C., P.V.C., R.I.L.C., V.C.I.L.C. All sizes in stock at our London works. Cutting and delivery same day as order received. Priced stock lists.—Batt Electrical Co., 6, Dock St., London, E.1 (Tel. Royal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Clive Street, Bury (Telephone, Bolton 27251). 212

FOR sale, good unused and used machinery including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FOR sale, one 7-panel D.C. vertical flat back type switchboard, suitable for use on a 220-volt, 2-wire system. Including 4 generator panels and 3 feeder panels with appropriate switches, circuit breakers and meters. For further details and permission to view apply to—The City Water Engineer, Denton House, Iffley Turn, Oxford. 2237

GEARED motorised units. If the call is urgent within the fractional range, phone CLE. 4141.—Jeary Electrical, 132, East Road, London, N.1. 127

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

INSULATING varnish, clear, Minerva No. 720, £10 per 40-gal. drum.—Lowton Metals Ltd., Sandy Lane, Lowton St. Mary's, Leigh, Lancs. (Tel. 71441/2). 93

KARDEX, Roneodex and Shannovue cabinets, as new. — F. H. Jolly & Co. Ltd., 280, King St., London, W.6 (RIV. 5381). 202

LIGHT fittings made to order—any design. Neon Construction Co. Ltd., 20, Calvin Street, London, E.1. 2230

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

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PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1, 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road. London, E.C.1. 36

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QUARTERLY credit meters, single and poly-phase, 2½-100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BR screws and nuts in steel, brass and stainless steel, from stock. — Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters and time switches. Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

TEN plating rectifiers by Davenset, 1,000 amps., 8 volts, oil immersed, with fine and coarse regulation. £350 ea.—Stewart Thomson Ltd., Seaforth, Liverpool (Bootle 2697/8). 2191

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

2 Hewittic rectifiers, 400 volts, 3-phase, 50 cycles, output 110 volts, 60 amps., in first-class condition. 1 motor generator set, 3-phase, 400/440 volts, 50 cycles input, 110 volts, 100 amps. D.C. output, in reasonable condition. 1 petrol-driven generating set, ex W.D., not used, 15 kW, 230 volts, single-phase, 50 cycles. —L. Adlington & Sons Ltd., Spalding (Tel. 3888/9). 2108

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0/220	0/230	W'HOUSE (U.S.A.)	0/1750
0/130/150	0/500/500	M. & PLATT	0/360/460
0/120	0/230	G.E.C.	0/960
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0/73/73	0/480/480	HARLAND	0/1200/1500
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2219

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400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

500-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

500-kVA English Electric diesel set, 415/3/50 at 750 r.p.m. Many spares. Little used.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1/2). 2271

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SURPLUS Diesel Generating Sets, all sizes up to 1,000 kW. We dismantle and remove.

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WANTED, one 75-h.p. or near, 460-volt D.C. motor, speed 1,000 r.p.m. With or without starter.—Box 2208.

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

WORK WANTED AND OFFERED

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COMPANY MEETINGS

COMBINED ELECTRICAL MANUFACTURERS

SATISFACTORY RESULTS OF MERGER

THE First Annual General Meeting of Combined Electrical Manufacturers Limited was held on 31st August in London, Mr. Anthony M. Browne (chairman) presiding.

The following is an extract from his circulated statement for the period ending 31st March, 1961:—

Combined Electrical Manufacturers Limited was formed a year ago to amalgamate Hackbridge and Hewittic Electric Company Limited and Switchgear and Cowans Limited together with their respective subsidiaries.

The products of these various companies—Transformers, A.C. and D.C. Switchgear and Rectifiers—are in a great measure complementary and required in connection with the Electric Supply Industry. Bertram Thomas, however, also have an important output in storage equipment known as "Tilt Racks" and supplied to many branches of industry.

The Directors are satisfied with the results of the merger. For shareholders there are the added advantages that the risks and opportunities are spread over a wider sphere of the industry.

The total dividend of 12½% is as forecast. We estimated that the combined profits would be at an annual level in the neighbourhood of £700,000. Allowing for the varying periods of the different companies the annual rate works out at approximately £675,000. The difference between the estimated and achieved figures is due to a combination of factors. Some large equipments which were planned for output in March could not be completed in time. The transference of production to the new factories at Thanet (New Switchgear) and Hulme (Bertram Thomas) which took place in the last months of the period under review had some temporary adverse effects on production.

The figures show that your companies have completed a successful trading period although conditions have been difficult owing to the reduced profit margins and the mounting cost of research and development which it is necessary to undertake. Only by improved organisation, higher productivity and increased turnover from all factories can the financial results be improved or maintained and our efforts are being concentrated in achieving these objectives.

The value of orders secured and anticipated in the Group are very satisfactory, enabling us to plan for an increased output which, barring unforeseen circumstances, we should be able to achieve.

Under the present national and international circumstances, it is more than usually difficult to make a forecast. Nevertheless we look forward with confidence to the results of the present year.

The plant supplied by our various companies continues to give good service and the names attached to our products stand for excellence in operation and in service given at home and in all parts of the world. Repeat orders, which have always been a regular feature in the history of our companies, continue to form the greater part of our order books. A good proportion of export business has also been maintained.

The report was adopted. 2220

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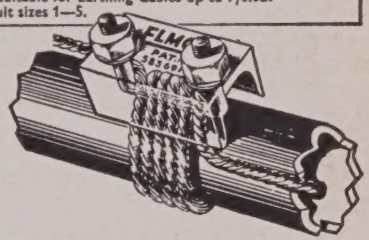
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to fit B.S. conduit sizes	1, 2 & 3	4 & 5	6 & 7	8, 9 & 10
i.e. in trade terms	½" to ¾"	1" and 1¼"	1½" and 2"	2½" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.

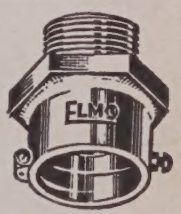
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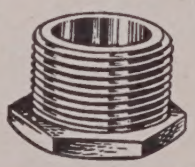
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Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal Threads suit all makes of flexible tubing.



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MALE
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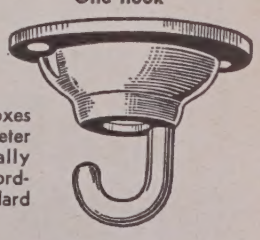


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Flat Face Section for Spanner (except ¾" size which is round)



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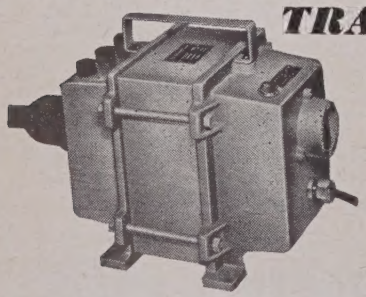
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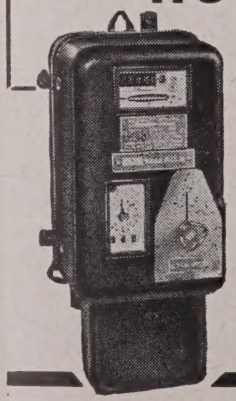
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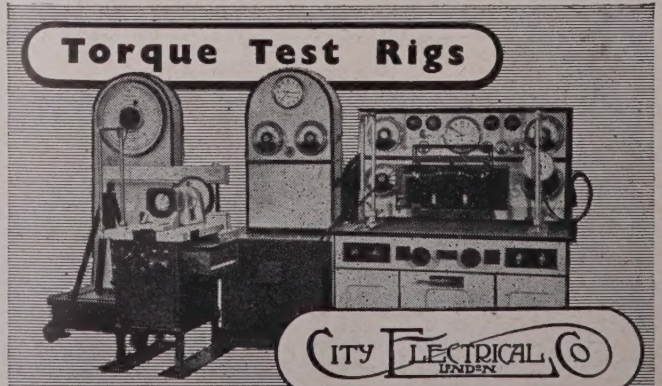
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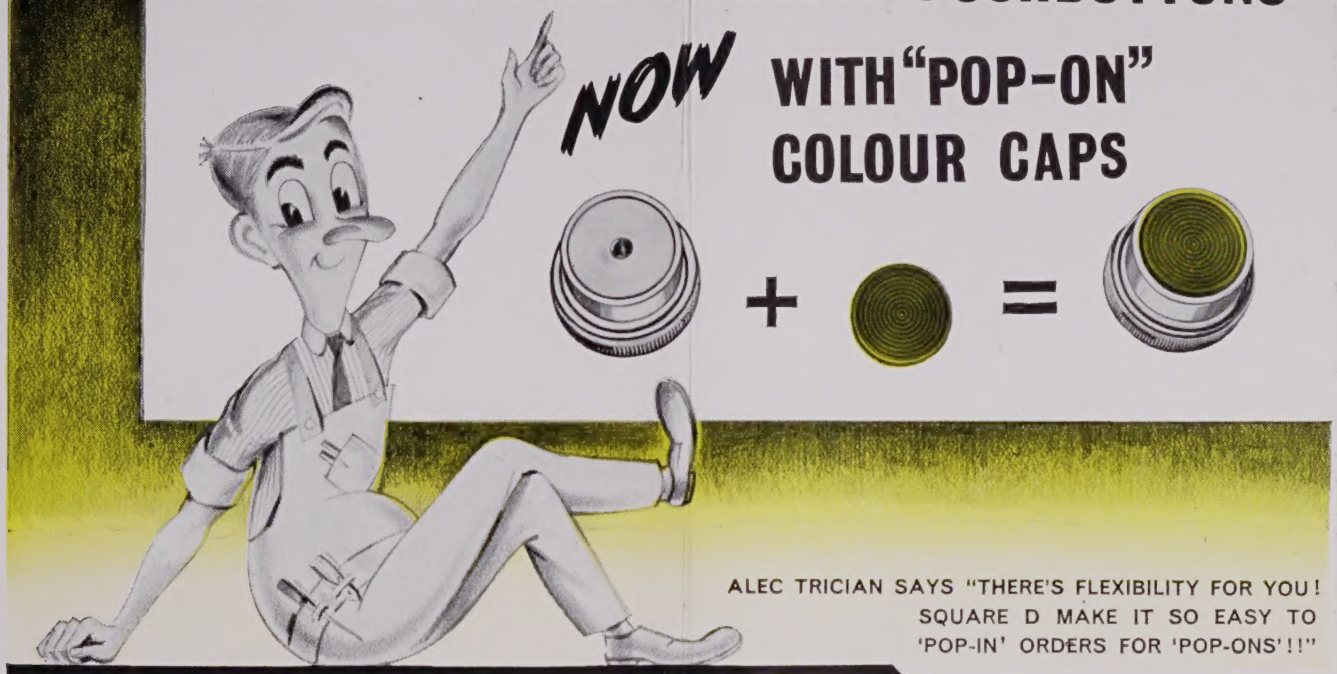


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